PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

Edited and Issued Monthly by

THE INSTITUTION OF ELECTRICAL ENGINEERS

In Association with

THE PHYSICAL SOCIETY

THE AMERICAN PHYSICAL SOCIETY

THE AMERICAN
INSTITUTE OF ELECTRICAL ENGINEERS

ABSTRACTS 1383–1691

VOLUME 50 **JUNE 1947** NUMBER 594

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RELATED SUBJECTS CONTAINED IN SECTION B (ELECTRICAL ENGINEERING ABSTRACTS)

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Non-destructive testing
Industrial radiography
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Electrical and magnetic measurements and instruments
Electronic relays and counters
Automatic control mechanisms
Applied electrochemistry
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Thermionic tubes
Cathode-ray tubes
X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, ":" e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[Continued on page 3 of cover

MATHEMATICS 51

7.92 1383
Two notes on phase-integral methods. FURRY, W. H. *Phys. Rev.*, **71**, 360–71 (*March* 15, 1947).

3.5 : 621.317.39 1384
An electrical network for the solution of secular equations. HUGHES, R. H., AND WILSON, E. B., JR. *Rev. Sci. Instrum.*, **18**, 103–8 (*Feb.*, 1947).—By plugging suitable coils and capacitors into a panel board, a network is assembled which has for its description at resonance an equation identical with the secular determinant. While the network is excited with alternating current, variable admittances representing the unknowns are all altered simultaneously by the same amount until all the maxima have been found. The values of the admittances at the several maxima constitute the desired roots. Usually an accuracy of better than 1% is obtained. A.

518.5 : 621.317.757 = 82 1385
A new electrical apparatus for harmonic analysis and synthesis. TOLSTOV, V. G. *Bull. Acad. Sci. URSS, Dep. Sci. Tech.* (*No.* 3) 389–400 (1946) *In Russian.*—[Abstr. B (1947)].

519.25 1386
On the distribution of relative errors from a normal population of errors. ARLEY, N. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **18** (*No.* 3) 6 *pp.* (1940).—The first problem is to devise a means for testing whether or not a given small sample of measurements has come from a normal population. The second problem is to test whether an unusually large error has to be rejected as being due to some false measurement. These questions are solved by deducing the distribution of the relative errors. Some numerical examples are given. L. S. G.

ASTRONOMY . ASTROPHYSICS . GEODESY 52

1.042 : 523.112 : 539.17 *see Abstr.* 1618

2 : 535.393 : 535.87 = 5 1387
Aluminizing of astronomical reflectors. ABETTI, G., AND RACASTORO, M. G. *Ric. Sci.*, **12**, 571–6 (*May*, 1941) *Italian.*—Previous experience is briefly reviewed [Abstr. 3532 (1933), 3066 (1936)] and the superior reflecting power of Al in the u.v. illustrated by examples. Results are given of experiments at Arcetri with small prismatic reflectors and the spectrograph. Photographic intensity of spectrograms of stars and the light of the sky was measured, obtained with silvered and aluminized reflectors. J. A. W.

22.23 : 621.383 1388
Photo-electric sight for solar telescope. ROBERTS, W. D. *Electronics*, **19**, 100–3 (*June*, 1946).—[Abstr. 1506 B (1947)].

22.33 = 4 1389
Study of two transit instruments. DANJON, A. *Bull. Astr., Paris*, **13** (*No.* 1) 3–18 (1947) *In French.*—Gives the results of simultaneous observations made in 1935, to compare two different types of transit instrument, with details of the instrumental errors. E. G. M.

23.11 : 523.874 : 523.852.3 1390
On the cause of the red shifts in the spectra of the extra-galactic nebulae. WHITROW, G. J. *Phil. Mag.*, **37**, 69–79 (*July*, 1946).—Two different scales of uniform time were previously suggested [Abstr. 2321 (1938)] and this duality is now accounted for. Improbable consequences would result if the uniform time-scale of atomic phenomena was the same as the time-scale of classical mechanics, which can be associated with a static universe, e.g. Hubble's static universe of uniformly radiating nebulae. A possible explanation for the existence of the red-shifts in the spectra of these nebulae is suggested. On the average the spectral shift of a particular nebula, as observed from any other given nebula, is the same at all epochs. The possibility of a laboratory test to confirm the existence of the *t*-scale in nature is indicated. L. S. G.

523.112 : 521.042 : 539.17 *see Abstr.* 1618

523.53 : 621.396.96 1391
Radar observations of the Draconids. STEWART, J. Q., FERENCE, M., SLATTERY, J. J., AND ZAHL, H. A. *Sky and Telescope*, **6**, 3–5 (*March*, 1947).—Gives an account of results obtained at a number of stations in the U.S.A. on Oct. 9, 1946, from observations of meteors (Giacobinids). Details of the apparatus are given. E. G. M.

523.661 1392
Structure and mass of cometary nuclei. VORONTSOV-VELYAMINOV, B. *Astrophys. J.*, **104**, 226–33 (*Nov.*, 1946).—The width and luminosity of the Fraunhofer spectrum give the diameter and reflecting-surface area, while the number of molecules ejected (estimated from the comet's monochromatic luminosity) yields an estimated nuclear mass through known meteoric gas contents. The theory is applied to observations of Halley's comet. D. L. E.

523.72 1393
Micro-wave solar noise observations during the partial eclipse of November 23, 1946. COVINGTON, A. E. *Nature, Lond.*, **159**, 405–6 (*March* 22, 1947).—A definite drop was observed 3 min before first contact, indicating radiation from the corona or a prominence. About ½ the fall of noise activity during the eclipse occurred only during the period when a small region (2·2% of sun's projected area), containing a large group of sunspots, was obscured.

523.72 1394
Radio noise from the sun at 3·2 cm. SANDER, K. F. *Nature, Lond.*, **159**, 506–7 (*April* 12, 1947).—Results of measurements made with a receiver of 2° beam width during the partial solar eclipse of July 2, 1945, are shown on a graph, with two curves for comparison: fraction of sun's (*a*) circumference, (*b*) area, obscured. The observations, though not of high precision, fall closer to the former. See Abstr. 195 (1947).

523.72 : 523.752 = 3 *see Abstr.* 1398

523.72 : 550.385 = 3 1395
A slow-particle radiation of the sun. KIEPENHEUER, K. O. *Naturwiss.*, **33**, 118 (*Aug.* 30, 1946) *In German.*—Weak geomagnetic disturbances are explained by particles travelling from prominences, with the speed (~500 km/sec) likely if accelerated by $Ly\,\alpha$ radiation of the intensity inferred from ionospheric ionization. Magnetic fields inhibit any similar emission from prominences above a spot. T. G. C.

523.742 1396
The distribution of brightness at the extreme limb of the sun. KOPAL, Z. *Astrophys. J.*, **105**, 60–74 (*Jan.*, 1947).—The distribution over the last 1% of the sun's radius is

determined from 1936 eclipse measures of integrated light just before totality. The integral equation is solved numerically. The brightness is shown to remain finite up to the sun's limb, where it is 21% of the central intensity. T. G. C.

523.75 1397

The effect of the absorption lines on the temperature distribution of the solar atmosphere. MÜNCH, G. *Astrophys. J.*, **105**, 87–109 (*Jan.*, 1947).—Chandrasekhar's method [Abstr. 2027 (1946)] is applied to calculate the temperature distribution, assuming the probability of an absorption line at frequency ν is $w(\nu)$. Numerical results correspond to $w(\nu) =$ constant, lines arising by absorption and scattering, or $w(\nu)$ of observational form, lines arising by pure absorption. The calculated boundary temperature is ~4 600°K. The predicted darkening agrees with observation up to 0·95(radius) from the disc centre. T. G. C.

523.752 : 523.72 = 3 1398

The interpretation of chromospheric turbulence and of the excess of solar UV-radiation. BIERMANN, L. *Naturwiss.*, **33**, 118–19 (*Aug.* 30, 1946) *In German.*—Radiation producing the ionosphere must come from the chromosphere. Shock waves (the observed turbulence) are proposed as the cause; these are stimulated by subsonic photospheric motions, speeding up like $\rho^{-\frac{1}{2}}$ as they pass into regions of smaller density ρ. T. G. C.

523.755 = 3 1399

A new determination of the temperature of the corona. WALDMEIER, M. *Experientia*, **2** (*No.* 12) 493 (1946) *In German.*—The determination depends on the observed distribution of the elements in the corona over many consecutive ionization stages. The result is ~630 000°C. A.

523.76 : 523.877 1400

On the helium content of the sun. SCHWARZSCHILD, M. *Astrophys. J.*, **104**, 203–7 (*Nov.*, 1946).—The sun is supposed to consist of fractions X of H, Y of He and $1 - X - Y$ of Russell mixture. By using the mass-luminosity and energy-generation equations, X and Y are determined as 47% and 41%. T. G. C.

523.77 : 551.521.1 1401

Solar spectroscopy at high altitudes. STRAIN, C. V. *Sky and Telescope*, **6**, 3–6 (*Feb.*, 1947).—A preliminary account of V2 rocket flights, made to photograph the sun's ultraviolet spectrum. T. G. C.

523.774 1402

On the centre-limb variation of Fraunhofer lines on the sun's disc. TEN BRUGGENCATE, P. *Naturwiss.*, **33**, 91–2 (*Aug.* 15, 1946) *In German.*—The centre-limb variation of line-wings is shown to be determined solely by that of the continuous spectrum, assuming a constant ratio of line-absorption to continuous. T. G. C.

523.775.2 1403

Chromospheric spectrum from ten expeditions. MITCHELL, S. A. *Astrophys. J.*, **105**, 1–35 (*Jan.*, 1947).—Estimated intensities and heights in km are given for 3 500 lines between 3 066 and 8 862 Å from slitless flash spectra. A revision of previously published data is combined with results from the 1930 and 1937 eclipses. D. L. E.

523.775.2 1404

An interpretation of the heights of lines in the solar chromosphere. WILDT, R. *Astrophys. J.*, **105**, 36–84 (*Jan.*, 1947).—The observed relation between theoretical intensities of related lines and their chromospheric heights is developed theoretically, with corrections for lunar motion during exposure and atmospheric tremor. Application to Mitchell's data [Abstr. 1403 (1947)] yields density gradients and relative abundances of different elements, with deductions as to the physical constitution of the chromosphere. D. L. E.

523.83 1405

Wave-length standards for radial-velocity determinations. PETRIE, R. M. *J. R. Astr. Soc. Can.*, **40**, 325–30 (*Oct.*, 1946).—Wavelengths for (*a*) high, (*b*) moderate dispersions are based on Rowland's solar tables, checked by solar system observations and standard velocity stars. Standards for lines or blends not variable with type are given for stars of types F4 to K8. D. L. E.

523.83 : 523.851.2 1406

The radial velocities of fifty globular star clusters. MAYALL, N. U. *Astrophys. J.*, **104**, 290–323 (*Nov.*, 1946).—Out of 50 velocities measured with low-dispersion spectrograph, 19 are +, 31 are −. All fall within the previously known range +291 to −360 km/sec, the excess − velocities being due to selection. The spectral types probably range from A5 to G5. A number of solar-motion solutions indicate that (*a*) there is no K term, (*b*) no appreciable deviation of the computed apex from the one generally assumed at galactic longitude 55° and latitude 0°, (*c*) the solar motion with respect to the clusters is 175 ± 25 km/sec, (*d*) from separate solutions from the two groups of clusters in the hemispheres containing the apex and antapex, the most probable value of the solar motion is 200 ± 25 km/sec. V. C. A. F.

523.841.37 : 523.87 *see Abstr.* 1412

523.842.3 1407

A study of the spectrum variables of type A. DEUTSCH, A. J. *Astrophys. J.*, **105**, 283–304 (*March*, 1947).

523.851.2 : 523.83 *see Abstr.* 1406

523.852 : 523.877 : 537.122 1408

The electron velocity-distribution in gaseous nebulae and stellar envelopes. BOHM, D., AND ALLER, L. H. *Astrophys. J.*, **105**, 131–50 (*Jan.*, 1947).—Boltzmann's equation is used to show that the velocity-distribution is nearly Maxwellian in a typical planetary nebula. Hagihara's non-Maxwellian distributions [Abstr. 3075 (1940), 986 (1941)] are approximations to Maxwellian ones at a different temperature. T. G. C.

523.852.3 : 523.874 : 523.11 *see Abstr.* 1390

523.852.32 1409

On the direction of rotation in spiral nebulae. LINDBLAD, B., AND BRAHDE, R. *Astrophys. J.*, **104**, 211–25 (*Nov.*, 1946).—Discusses the direction of tilt of spiral nebulae to the line of sight. Photometric study of the distribution of intensity and colour for typical nebulae leads to conclusions identical with those derived earlier regarding the "secondary" absorption on the distant half of the nebula. The dissolution of a system into spiral structure proceeds so that the arms open up in the direction of rotation. Certain similarities between the outer diffuse spiral structure of NGC 2681, which shows a direction of winding opposite to that of the interior main spiral structure, and certain theoretical spiral arms, are pointed out. V. C. A. F.

523.87 1410

The continuous spectrum of the sun and the stars. CHANDRASEKHAR, S., AND MÜNCH, G. *Astrophys. J.*, **104**, 446–57 (*Nov.*, 1946).—It is shown that the change of the continuous absorption coeff. with wavelength above 4 000 Å in the sun can be quantitatively accounted for by negative hydrogen ion absorption. Observed stellar colour-temperatures can also be interpreted in terms of absorption by H^- and neutral H. D. L. E.

23.87 1411

The relative intensities of the coronal and other forbidden lines. BOWEN, I. S., AND SWINGS, P. *Astrophys. J.*, **103**, 92–5 (*Jan.*, 1947).—Coronal lines observed in stellar spectra show intensity variations as expected from intensity differences and variations in the exciting radiation due to continuous H and He II absorption. Edlen's predicted [K XI] line at 4 258·7 Å appears in R. S. Oph., in addition to strong [K IV] and [K V]. D. L. E.

523.87 : 523.841.37 1412

The spectrum of cluster-type cepheids. MÜNCH, G., AND TERRAZAS, L. R. *Astrophys. J.*, **104**, 369–72 (*Nov.*, 1946).—Spectra of RR Lyrae in relation to its light curve show later types from H than from metallic lines. The latter agree with colour equivalents determined by Pikhoff's method. Seven other cluster variables are found to be similarly peculiar. D. L. E.

523.87 : 535.343.4–31 *see Abstr.* 1486

523.87 : 538.615 1413

Zeeman effect in stellar spectra. BABCOCK, H. W. *Astrophys. J.*, **105**, 105–19 (*Jan.*, 1947).—Rapidly rotating stars with axes directed towards the earth have sharp lines, and may show measurable Zeeman effects due to the magnetic fields associated with the rotation. Observations are given of such effects in 78 Vir., indicating a polar-field strength of 1 500 gauss, in agreement with the theory developed for a normal triplet and integrated over the visible hemisphere. D. L. E.

523.872 : 535.343 1414

On the continuous absorption coefficient of the negative hydrogen ion. III. CHANDRASEKHAR, S., AND BREEN, F. H. *Astrophys. J.*, **104**, 430–45 (*Nov.*, 1946).—See Abstr. 246 (1946). The contribution by free-free transitions is evaluated. The new coefficients are larger than earlier estimates by factors >10 over the whole range of wavelengths of astrophysical interest. Tables of the coefficient, including bound-free and free-free transitions for a temperature range of 2 520° to 10 080° and for wavelengths >4 000 Å are provided. V. C. A. F.

523.874 : 523.852.3 : 523.11 *see Abstr.* 1390

523.877 1415

Radial oscillations of a rotating star. BHATNAGAR, K. L. *Bull. Calcutta Math. Soc.*, **38**, 93–5 (*June*, 1946).—The stellar model considered is one in which the strata of equal density are similar spheroids and which is uniformly rotating, so that at a given instant the angular velocity is the same throughout the mass. An expression is obtained for the frequency of oscillation [see Abstr. 2459 (1946)]. L. S. G.

523.877 1416

On the dynamical stability of stars. LEDOUX, P. *Astrophys. J.*, **104**, 333–46 (*Nov.*, 1946).—It is shown that, even if the ratio of specific heats is much smaller than $\frac{4}{3}$ in a part of a star, that part has to extend over a large fraction of the radius to render the star unstable. T. G. C.

523.877 1417

The internal temperature-density distribution of main-sequence stars built on the point-convective model. II. Sirius A. MARSHAK, R. E., AND BLANCH, G. *Astrophys. J.*, **105**, 82–6 (*Jan.*, 1947).—Describes a numerical integration, using Morse's opacity tables, and allowing for electron scattering. He is supposed absent; 37% by mass must be H. The central density and temperature are 43 gm/cm³ and $30{\cdot}7\times10^6$ °C. The energy generated by the carbon cycle would be 60 times that radiated. T. G. C.

523.877 1418

On the radiative equilibrium of a stellar atmosphere. XIII. CHANDRASEKHAR, S. *Astrophys. J.*, **105**, 151–63 (*Jan.*, 1947).—The diffuse reflection of a partially polarized beam is considered. Helmholtz' principle of reciprocity is formulated in simple terms, using a scattering matrix. T. G. C.

523.877 1419

On the radiative equilibrium of a stellar atmosphere. XIV. CHANDRASEKHAR, S. *Astrophys. J.*, **105**, 164–203 (*Jan.*, 1947).—Following Ambarzumian, functional equations are derived, giving the diffuse reflection of an atmosphere, and are reduced to a simple standard form. Earlier results in this series of papers are equivalent to approximate solutions of these equations. The functional equations are solved for reflection with Rayleigh's phase function. T. G. C.

523.877 : 523.76 *see Abstr.* 1400

523.877 : 537.122 : 523.852 *see Abstr.* 1408

PHYSICS 53

53 1420

Physics in 1946. MORRISON, P. *J. Appl. Phys.*, **18**, 33–52 (*Feb.*, 1947).

53.081.3 : 531.7 : 535.241.34 : 621.317.081.3 1421

International Committee of Weights and Measures. *Nature, Lond.*, **159**, 325–6 (*March* 8, 1947).—A report of the plenary session, Oct. 22–29, 1946. The absolute electrical units based on the M.K.S. or C.G.S. system are to replace the international units ($1\ ohm_{int.} = 1{\cdot}00049\ ohm_{abs.}$; $1\ volt_{int.} = 1{\cdot}00034\ volt_{abs.}$) and the new unit of candle power is to be defined in terms of a black-body radiation at melting Pt temperature. The International Kilogramme and Metre standards have been recompared.

FUNDAMENTALS 530.1

530.12 1422

Note on rotational motion in relativity theory. HILL, E. L. *Phys. Rev.*, **71**, 318–19 (*March* 1, 1947).—Rosen's conclusion [Abstr. 1121 (1947)], that a disc rotating with a given angular velocity cannot exceed a limiting size, is criticized but an alternative approach cannot be suggested. W. E. D.

530.12 : 531.51 1423

On the relativistic analogue of Earnshaw's theorem on the stability of a particle in a gravitational field. DATTA MAJUMDAR, S. *Bull. Calcutta Math. Soc.*, **38**, 85–92 (*June*, 1946).—It is shown that the proper co-ordinate system in which the theorem can be enunciated in a static gravitational field is one which is locally Galilean. In such a system gravitational phenomena will agree with the findings of a local observer in his immediate vicinity using his proper time and distance. L. S. G.

530.12 : 538.56 = 4 *see Abstr.* 1580

530.14 1424

Remarks on Dr. Bhabha's note "On the expansibility of solutions in powers of the interaction constants." ARLEY, N. *Phys. Rev.*, **71**, 272–3 (*Feb.* 15, 1947).—[See Abstr. 1124 (1947)].

530.14 = 3 1425

Mathematical limits to the quantum theory of fields. HEISENBERG, W. *Z. Naturforsch.*, **1**, 608–22 (*Nov.-Dec.*,

1946) *In German.*—An account of the author's papers on this topic, the relevance of the *S*-matrix, and the presentation and extension of present theory under a single formalism. G. J. K.

530.145 : 539.18 1426

A theorem in the charge symmetrical meson theory. HEITLER, W. *Proc. R. Irish Acad.*, **51A** (*No.* 2) 33–9 (1946).—Their invariance in this theory under rotations in charge-space leads directly to a non-trivial relation between cross-sections for scattering of mesons by protons and neutrons. G. J. K.

530.145.6 1427

On the momentum operator in wave mechanics. WINTNER, A. *Phys. Rev.*, **71**, 547–8 (*April* 15, 1947).—A simple example shows that a standard tacit hypothesis concerning quadratic integrability in momentum space is not in general legitimate, if only quadratic integrability in configuration space is assumed. Inasmuch as only the latter assumption is justified, there arises the need for criteria which prevent the occurrence of this difficulty. Such a criterion is developed in terms of the qualitative behaviour of the potential. The conditions on the potential are of such a nature as to be satisfied in all cases which seem to be reasonable. A.

530.162 : 620.317.39 : 536.53 *see Abstr.* 1515

GENERAL MECHANICS . MECHANICS OF SOLIDS 531

531.19 : 536.48 : 536.23 = 5 *see Abstr.* 1508

531.19 : 536.7 = 5 1428

Observations on the intermediate statistics. CALDIROLA, P. *Ric. Sci.*, **12**, 1020–7 (*Oct.*, 1941) *In Italian.*—The assumptions underlying Gentile's statistics are discussed, and a similar formula is deduced from more general hypotheses. In the case of an Einstein gas, the two formulae lead to the same result. The case of very low temperature is specially considered. J. A. W.

531.382 : 621.316.718.5 1429

Speed control for the air-driven centrifuge. BEAMS, J. W., LINKE, F. W., AND SOMMER, P. *Rev. Sci. Instrum.*, **18**, 57–60 (*Jan.*, 1947).—[Abstr. 1410 B (1947)].

531.51 : 530.12 *see Abstr.* 1423

MECHANICAL MEASUREMENTS 531.7

531.7 : 535.241.34 : 621.317.081.3 : 53.081.3 *see Abstr.* 1421

531.715.1 : 535.417 *see Abstr.* 1496

531.758 : 533.12 1430

Tests of instruments for the determination, indication, or recording of the specific gravities of gases. SMITH, F. A., EISEMAN, J. H., AND CREITZ, E. C. *Misc. Publ. U.S. Bur. Stand.* (*No. M*177) 143 *pp.* (1947).—11 commercially available instruments were tested with 15 test gases, ranging from He to butane, and the errors of each are presented in tables and graphs, down to 0·0001 unit. Reproducibility, effect of ambient conditions, applicable corrections, and possible improvements are discussed. A.

531.775 : 621.317.083.7 : 621.317.39 1431

Production testing of tachometers. STORM, H. F. *Electronics*, **20**, 92–6 (*March*, 1947).—[Abstr. 1436 B (1947)].

531.787.2 1432

A recording optical manometer for transient pressures. SMITH, P. B. *J. Sci. Instrum.*, **24**, 134–6 (*May*, 1947).—An improved model [see Abstr. 2908 (1940)]. The record is made on film on a rotating drum by optic lever magnification of the movement of a diaphragn Pressures developing at 50 lb/in² m/sec can be readil recorded.

531.787.6 143

Vacuum micromanometer. YOUNG, W. S., AN TAYLOR, R. C. *Analyt. Chem.*, **19**, 133–5 (*Feb.*, 1947).—A gauge is described, suitable for the range 10^{-1} t 10^{-3} mm Hg. The movement of a bubble in a capillar tube between reservoirs of pentane is observed, but th pentane is isolated from the vacuum by barometric leg of Hg.

MECHANICS OF LIQUIDS 532

532.123 143

The measurement of elasticity in fluids of low viscosity VAN WAZER, J. R., AND GOLDBERG, H. *J. Appl. Phys.* **18**, 207–11 (*Feb.*, 1947).—By means of an apparatu applying an alternating shearing motion to a liquid, i was shown that fluids with a viscosity of around on poise have elastic properties. A discussion of the varia tion of the resonance maxima with the amount o damping is given, and the shear modulus and dampin viscosity are calculated for some dilute solutions of high polymeric materials. A

532.133 : 532.612.4 : 536.655 *see Abstr.* 1517

532.516 : 539.23 : 539.62 143

Lubricating properties of molecular layers of stearic acid and calcium stearate on metal surfaces. GREGORY J. N., AND SPINK, J. A. *Nature, Lond.*, **159**, 403 (*March* 22, 1947).—The temperature/friction variations of mixed molecular layers of soap and acid were investigated for Pt, Cu and stainless steel. A rise occurred for Pt and Cu at the m.p. of the acid; for Cu this was transitory, but a permanent rise occurred at the m.p. of Cu stearate. For Pt, a transitory rise occurred at the temp. of α-β phase change of the acid. For steel, no rise occurred till the m.p. of Ca stearate was reached. [See Abstr. 2783 (1946)].

532.528 1436

On cavity formation in water. HARVEY, E. N., MCELROY, W. D., AND WHITELEY, A. H. *J. Appl. Phys.*, **18**, 162–72 (*Feb.*, 1947).—High speed motion photographs were taken of the rapid movement of a 5 mm glass rod in a 16 mm glass tube of water. If the rod surface contained gas nuclei, or was hydrophobic, cavitation occurred at the rear end when the velocity <3 m/sec, but if completely hydrophilic and free of gas nuclei, the velocity could be 37 m/sec without cavitation. Movement of a rod in pure corn syrup (viscosity 20·1 poises), free of gas nuclei, left a large cylindrical cavity that collapsed in a matter of hundredths of a second. A.

532.582.3 = 4 1437

The effect of waves on the thrust on an obstacle in a viscous flowing liquid. DU BOSCQ DE BEAUMONT, H. *C.R. Acad. Sci., Paris*, **222**, 44–6 (*Jan.* 2, 1946) *In French.*—A theoretical study is made of the vortices set up when a cylinder is immersed in an infinite flowing viscous liquid, with the generators perpendicular to the direction of flow. A method for calculating the thrust on the cylinder is outlined. L. S. G.

532.6 : 536.423.4 1438

Growth of drops formed in a Wilson cloud chamber. BARRETT, E. O., AND GERMAIN, L. S. *Rev. Sci. Instrum.*, **18**, 84–9 (*Feb.*, 1947).—Water and water-alcohol drops were photographed with periodic illumination and their velocity measured. The drop size was determined by Stokes' law, and the (radius)² of the drop was found to

y linearly with time as soon as the drop was large ough to register photographically. The values $7{\cdot}5\times10^{-6}$ cm²/sec for water and $4{\cdot}4\times10^{-6}$ cm²/sec water-alcohol, though smaller during the first 1–0·2 sec. A.

CAPILLARITY 532.6

2.612.4 : 532.133 : 536.655 *see Abstr.* 1517

KINETIC THEORY OF LIQUIDS 532.7

2.74 : 535.343–15 *see Abstr.* 1480

2.74 : 537.228.4 1439

Theory of molecular coupling in polar liquids. PIEKARA, . *Nature, Lond.*, **159**, 337–8 (*March* 8, 1947).—The thor's previous theory [Abstr. 3630 (1939)] has been tended. Good quantitative agreement with experi- ental results on dielectric polarization and saturation, err effect and Cotton-Mouton effect of nitrobenzene in enzene solution is obtained by basing calculations on ie Onsager local field, with a second coupling between earest-neighbour pairs, and a third consisting of the utual interaction of these pairs.

MECHANICS OF GASES 533

33.12 : 531.758 *see Abstr.* 1430

33.15 : 539.132 = 3 *see Abstr.* 1587

33.15 : 541.183.56 1440

Molecular sieve action at low temperatures. BARRER, . M. *Nature, Lond.*, **159**, 508 (*April* 12, 1947).—Great ifferences in the sorbtion rate of O_2, N_2 and A on evynite were found at −184°C, sufficient for almost omplete separation of these gases. See Abstr. 522 1945).

33.6.011.1 1441

Streamlines for the subsonic flow of a compressible fluid ast a sphere. VAN DRIEST, E. R. *J. Appl. Phys.*, **18**, 94–8 (*Feb.*, 1947).—The second approximation to the elocity potential for the irrotational flow of a com- pressible fluid past a sphere [Abstr. 1394 (1940)] is used o calculate the subsonic streamlines for the flow of air t a Mach number of 0·5 past a sphere. Comparison is ade between these streamlines and those for the rrotational flow of an incompressible fluid. Velocity nd pressure comparisons are also shown. A.

533.6.07 : 621.34 1442

Electric equipment at the Langley Memorial Aero- nautical Laboratory. CLYMER, C. C., AND GARDNER, W. G. *Gen. Elect. Rev.*, **50**, 20–5 (*Feb.*, 1947).—[Abstr. 1480 B (1947)].

KINETIC THEORY OF GASES 533.7

533.7 : 536.782 1443

Joule-Thomson effects in hydrogen at liquid air and at room temperatures. JOHNSTON, H. L., BEZMAN, I. I., AND HOOD, C. B. *J. Amer. Chem. Soc.*, **68**, 2367–73 (*Nov.*, 1946).—Joule-Thomson effects in H_2 for pressures up to 200 atmos. and for isotherms at 64, 69, 75, 80 and 288°K have been studied, using a new apparatus [Abstr. 1445 (1947)]. The results have been plotted as curves of the cooling in °K *v.* the initial pressure. The low-temperature isotherms exhibit flat maxima at 150–157 atmos. The 288°K isotherm rises with an average Joule-Thomson coefficient of 2° rise per 68 atmos. drop. The data have been compared with those computed from existing *PVT* data by Deming and Shupe [Abstr. 4433 (1932)] and Brickwedde. Heat contents as functions of pressure and temperature have been computed; and the percentage liquefaction *v.* the initial pressure plotted for the 80, 75, 69 and 64° isotherms. W. R. A.

533.7 : 536.782 1444

Joule-Thomson effects in deuterium at liquid air and at room temperatures. JOHNSTON, H. L., SWANSON, C. A., AND WIRTH, H. E. *J. Amer. Chem. Soc.*, **68**, 2373–7 (*Nov.*, 1946).—The Joule-Thomson effect in D_2 has been measured for pressures up to 190 atmospheres at temperatures 64, 69, 75, 80 and 298°K, using a new apparatus [Abstr. 1445 (1947)]. An improved method of temperature and vacuum control was used involving the use of liquid N_2 as cryostat bath liquid. The low temperature isotherms exhibit a flat maximum at 163–170 atmospheres. The 64° isotherm lies above that for H_2 in the high pressure region, the difference diminishes with higher isotherms until the 75° isotherm lies below that of H_2. The 298° isotherm rises with an average Joule-Thomson coefficient of 2·1° rise per 68 atmospheres pressure drop. Values of the heat contents of D_2 as a function of initial pressure have been tabulated. W. R. A.

533.7 : 536.782.08 1445

An apparatus for measuring Joule-Thomson effects in gases by direct expansion through a valve. JOHNSTON, H. L. *J. Amer. Chem. Soc.*, **68**, 2362–6 (*Nov.*, 1946).—Errors due to thermal conduction at the valve are diminished by a special design, and the jet kinetic energy effect has been allowed for. The performance of the apparatus under various conditions of flow rate, pressure variations, inlet temperatures has been recorded, using H_2 gas. Results indicate that thermal conduction and jet kinetic energy effects have been eliminated. Equilibrium is attained in 5–10 min at high, and 15–30 min at low flow rates. W. R. A.

533.73 : 539.181 *see Abstr.* 1639–40

533.75 : 536.71 1446

On the equation of state for gases at extremely high pressure. BRINKLEY, S. R., JR. *J. Chem. Phys.*, **15**, 113–14 (*Feb.*, 1947).—Criticism. See Abstr. 1157 (1947).

VIBRATIONS. ACOUSTICS 534

534.113 : 539.32.08 *see Abstr.* 1655

534.113 : 539.433 : 620.178.311 = 3 1447

On transverse vibration and fatigue failures of rods. MATTHIEU, P. *Schweiz. Arch. angew Wiss. Tech.*, **12**, 329–36 (*Nov.*); 361–72 (*Dec.*, 1946) *In German.*—Peculiar failures occurring on propellers, turbine blading, etc., are caused by periodic shock or dynamic loading. The break often occurs near the free tip, and there need be no resonance between the natural frequency of the rod and the cyclical dynamic loading in order to cause failure. In this paper the modes of vibration and stresses of a rod clamped at one end, due to periodic movement of the clamping support and due to shock loading, are calculated. It is shown that for the fundamental mode of vibration the rod breaks at the clamping support, while for the harmonics the break can occur near the free tip. Calculations are given for parallel and tapered rods and tests are described. It is found that if a rod is subjected to a shock loading near the clamping support the break will usually occur at the free tip. If the loading is some distance from the clamping support the break usually occurs at the support. W. R.

534.2 : 550.34 = 5 1448

On the coefficient of absorption of superficial seismic waves. VALLE, P. E. *Ric. Sci. Ricostruz.*, **16**, 1666–8 (*Nov.*, 1946) *In Italian.*

534.21 : 535.314 : 621.396.11 1449

A device for plotting rays in a stratified medium. LAWSON, A. W., MILLER, P. H., JR., AND SCHIFF, L. I. *Rev. Sci. Instrum.*, **18**, 117–20 (*Feb.*, 1947).

534.213 1450

A photo-elastic study of stress waves. SENIOR, D. A. *Phil. Mag.*, **37**, 463–9 (*July*, 1946).—Stress waves set up by impact were examined by flash photography of the associated photo-elastic fringes using an Arditron discharge tube. The method is described. L. S. G.

534.213 : 550.341 1451

On the propagation of seismic waves. I–II. SCHOLTE, J. G. *Proc. K. Ned. Akad. Wet.*, **49**, 1115–26 (*Dec.*, 1946); **50** (*No.* 1) 10–17 (1947).—The movement caused by a normal pressure, periodic in time and uniformly exerted on the surface of a mono-stratified medium, has been calculated. By means of a Fourier integration this simple pressure distribution can be transformed into a pressure concentrated in a point. The corresponding surface movement is found by application of the saddle point integration method. A second Fourier integration changes the periodic normal pressure into a pressure existing only during a finite time; the movement caused by this disturbance has been investigated. The amplitudes of the seismologically important first impulses are calculated, and the travel times of the major parts of the movement have been determined. This method is generally applicable to the propagation of seismic waves in any horizontally stratified medium. A.

534.222.1 1452

Note on the scattering of radiation in an inhomogeneous medium. PEKERIS, C. L. *Phys. Rev.*, **71**, 268–9 (*Feb.* 15); *erratum*, 457 (*April* 1, 1947).—An expression is derived for the scattering of a plane sound wave when passing through a medium in which the velocity of sound fluctuates slightly and irregularly about a mean value. W. E. D.

534.222.2 = 3 1453

Detonations as physical and mathematical problems. FURRER, W., AND WEBER, H. *Tech. Mitt. Schweiz. Telegr.-TelephVerw.*, **24**, 241–9 (*Dec.* 1, 1946) *In German.*—Using a quartz piezo-electric microphone, oscillograms of the sound pressure of the detonations of a great number of firearms were made. An analytic expression is obtained for the general form of the variation of pressure with time. The acoustic energy and the frequency spectrum of a detonation are calculated. An application to the design of an ear shield to protect the ear from the effects of a detonation is described. P. O.

534.222.2 : 541.126 *see Abstr.* 1662

534.321.9 1454

Origin of excess ultrasonic absorption in water. HALL, L. *Phys. Rev.*, **71**, 318 (*March* 1, 1947).—The excess absorption is due to a lag in the rearrangement of the water molecules to closer packing under acoustic compression. The formula derived agrees with experiment within the limits of experimental error. W. E. D.

534.321.9 : 536.633 1455

Supersonic velocity in gases and vapours. X. Molecular heats of some vapours. JATKAR, S. K. K., AND LAKSHMINARAYANAN, D. *J. Indian Inst. Sci.*, **28A** (*Pt I*) 1–15 (1946).—Results of measurements on steam, CCl_4, CCl_2F_2 and various organic substances are given. Values of the specific heat, calculated from the observed supersonic velocity, are compared with theoretical values and also with values obtained by calorimetric methods. The results show a systematic negative deviation of about 1–2% from the theoretical values, which is within the errors of assumptions in the theory. The importan of experimental details, such as purity of the substanc frequency calibration and temperature control, is stresse G. F.

534.321.9 : 536.633 145

Supersonic velocity in gases and vapours. XI. Di persion in CO_2, CS_2, N_2O and CH_3CHO. JATKA S. K. K., AND LAKSHMINARAYANAN, D. *J. Indian Ins Sci.*, **28 A** (*Pt* 1) 15–27 (1946).—Results have been studie in the light of the collision theory, the data for superson velocities being converted into specific heats. Earlie conflicting results for N_2O are shown to be due to superposition of the tube-effect on dispersion. Th previously reported low-frequency dispersion region fo acetaldehyde is shown to be due to the tube factor, th two actual dispersion regions at 20°C being due to partia disappearance of the deformation and the entire deforma tion oscillations respectively. G. F. H

534.321.9 : 536.633 145

Supersonic velocity in gases and vapours. XII. Dis persion of molecular heats of organic vapours. JATKAR S. K. K., AND LAKSHMINARAYANAN, D. *J. Indian Inst Sci.*, **28 A** (*Pt* 1) 30–9 (1946).—The available results are summarized and compared with calculated values of the specific heats, close agreement being obtained. The results are discussed and it is pointed out that most of the molecules showing dispersion even at 100 kc/s are long-chain molecules whose moment of inertia round one axis is very low compared with those around the other axis. This indicates that the loss of specific heat is connected with the rotational energy of the molecule which must be excited before the vibrations can be affected. G. F. H.

534.414 = 3 1458

Characteristics of single and multiple cylindrical acoustic resonators. WIRZ, P. *Helv. Phys. Acta*, **20** (*No.* 1) 3–26 (1947) *In German.*—The paper deals with the frequency and damping characteristics of cylindrical acoustic resonators (organ pipes) and derives a formula for the end correction in frequency. Use is made of results on the fine structure of the resonance curves of acoustic resonators [Abstr. 1514 (1942)]. A. B. W.

534.75 = 3 1459

Contribution to the establishment of the orthotelephonic transmission system. WEBER, H. *Tech. Mitt. Schweiz. Telegr-TelephVerw.*, **24**, 145–9 (*Aug.* 1, 1946) *In German.*—The sound pressure at a point located in the entrance to the ear canal was compared with the value of the pressure at the same point in the absence of the subject, when listening to a source of sound in normal rooms and also in sound absorbing rooms. A new artificial ear is described, having an additional cavity coupled through a damped passage. It shows good agreement with human ears in its acoustical impedance and measured response. The probe microphone used in this work is described. P. O.

534.862.4 : 621.395.623.7 = 396 1460

Modern loudspeaker problems in design of radio receivers. TANDBERG, V. *Elektrotek. Tidsskr.*, **60**, 98–104 (*March* 25, 1947) *In Norwegian.*—[Abstr. 1568 B (1947)].

534.88 1461

Acoustic locating system. WALKER, E. A., AND KENDIG, P. M. *Electronics*, **20**, 124–7 (*Feb.*, 1947).—A system used for tracking torpedoes lost during test runs. In the torpedo, a battery-operated 24·5 kc/s oscillator drives a magnetostriction transducer mounted in the side. The transducer consists of a diaphragm on which is mounted a Ni tube surrounded by a driving coil and with a permanent magnet inside. The hydrophone at the search

ip also has a magnetostriction transducer with direc- nal properties, trained from the deck. The paper scusses the choice of frequency, the operating pressure ensities and the polar diagrams. H. G. M. S.

OPTICS . RADIATION . SPECTRA 535

5.215 : 537.533 *see Abstr.* 1540

5.215.5 1462

Fatigue of Ag-Cs_2O, Ag-Cs photo-electric surfaces. KSWER, S. *J. Appl. Phys.*, **18**, 203–6 (*Feb.*, 1947).— blue light the long-wave threshold shifts to shorter avelength and the long-wave max. increases and some- nes shifts to shorter wavelength. Rise of temperature the cathode counteracts the phenomena. In red light mperature effects are dominating. The observed enomena are in line with de Boer's theory, as the rmation of positive ions on the surface causes polariza- on of the neighbouring Cs-atoms and a change in their lective absorption. A.

35.241.34 : 621.317.081.3 : 531.7 : 53.081.3 *see Abstr.* 1421

35.243 = 4 1463

Comparison of line and continuous spectra by means of notographic spectrophotometry. LAFFINEUR, M. *Rev. pt. (Théor. Instrum.)* **25**, 219–26 (*Sept.–Oct.*, 1946) *In rench.*—The method is based on the fact that as the pectrograph slit is opened the blackening on the plate ue to a line does not increase at the same rate as that ue to a continuous spectrum. The theory of this effect discussed at length and the method is employed for a tudy of the complex radiation (lines superposed on a ontinuous spectrum) emitted by a fluorescent lamp ontaining Hg at low pressure. A. H.

35.313 1464

On reflexion at a spherical mirror. FISHTER, G. E. . *Sci. Instrum.*, **24**, 97–8 (*April*, 1947).—A geometrical onstruction is given for determining the position of the nage formed by a spherical mirror. The construction is sed to develop algebraic expressions for the longitudinal pherical aberration, and the sine condition error, nabling rapid calculations to be made. A.

35.314 1465

An optical magnification for finite objects. HOPKINS, H. H. *Nature, Lond.*, **159**, 573–4 (*April* 26, 1947).— A relation is derived, similar to the one for small objects etween refractive index, paraxial angle and size, but sing sagittal paraxial angles and sagittal object and mage heights, for image formation at a spherical efracting surface.

35.314 : 621.396.11 : 534.21 *see Abstr.* 1449

35.317 : 778.35 1466

Recent developments in lenses for aerial photography. INGSLAKE, R. *J. Opt. Soc. Amer.*, **37**, 1–9 (*Jan.*, 947).—An account of American developments since 939. H. H. HOP.

35.317.25 : 535.8 : 535.42 = 3 *see Abstr.* 1498

35.338 1467

Extended sum rules for transition arrays. MENZEL, D. H. *Astrophys. J.*, **105**, 126–30 (*Jan.*, 1947).—The ums cover not only transitions between all multiplets rom initial and final arrays of electron states, but all rrays formed from a given core + one electron, and ll transitions from a given shell. G. J. K.

35.338 1468

Pressure effect on the AlD band λ4200. NILSSON, B. E. *Ark. Mat. Astr. Fys.*, **33 B** (*No.* 4) *Paper* 9, 7 *pp.* (1947).—New measurements of rotational structure and analyses of the 0,1 and 1,3 bands are given. The constants derived include $\omega_e'' = 1\,211{\cdot}95$, $x_e''\omega_e'' = 15{\cdot}14$, $B_e'' = 3{\cdot}318_6$, $\alpha_e'' = 0{\cdot}0697$, $B_0' = 3{\cdot}165$. Some observations on the formation of AlH by discharges through $AlCl_3$–H_2 mixtures are reported. R. F. B.

535.338.3 : 538.615 = 4 1469

The nature of certain forbidden lines of helium, and the interpretation of their Zeeman effect. BROCHARD, J., AND JACQUINOT, P. *Ann. Phys., Paris* (*Sér.* 11), **20**, 509–34 (*Sept.–Oct.*, 1945) *In French.*—Lines of the type *P–F*, *P–P*, *P–G* in He I were studied experimentally. The results may be interpreted by assuming that these lines are due to a forced dipole electric moment. It is necessary to assume that the magnetic field imposes a particular structure on the inter-ionic electric field producing the lines. L. P.

535.338.4 1470

Emission bands of halogens. I. Iodine bands arising in O_u^+ state at 51 683 cm^{-1}. VENKATESWARLU, P. *Proc. Indian Acad. Sci. A*, **24**, 480–6 (*Dec.*, 1946).—In the diffuse fluctuation bands of the emission spectrum of iodine are 5 groups each involving a frequency difference of approx. 154 cm^{-1} and interpreted as arising from transition from a common initial level (O_u^+) to 5 different final levels, all of which are repulsive states with potential energy curves of varying slopes. Coupling conditions in I_2 are of Hund's case (*c*). [See Abstr. 1482 (1947)]. W. R. A.

535.338.4 : 539.132 1471

The asymmetric rotor. IV. An analysis of the 8·5-μ band of D_2O by punched-card techniques. KING, G. W. *J. Chem. Phys.*, **15**, 85–8 (*Feb.*, 1947).—[See Abstr. 5018 (1935), 1292 (1946)].

535.338.4 : 539.132 1472

The asymmetric rotor. V. An analysis of the 3·7-μ band of H_2S by punched-card techniques. HAINER, R. M., AND KING, G. W. *J. Chem. Phys.*, **15**, 89–91 (*Feb.*, 1947).—[See Abstr. 2679 (1931), 1292 (1946)]. The band is identified as half of a fundamental of the asymmetric vibrational frequency, where the induced moment is parallel to the least axis of inertia.

535.338.4 : 539.133 *see Abstr.* 1589

535.338.4–15 : 539.133 1473

The infra-red spectrum of methyl fluoride. YATES, K. P., AND NIELSEN, H. H. *Phys. Rev.*, **71**, 349–59 (*March* 15, 1947).—All of the important bands in the spectrum except the 8μ (1 200 cm^{-1}) band, have been remeasured. The approximate average spacing between lines in the *P* and *R* branches of the parallel type bands was found to be about 1·7 cm^{-1}. New and more precise determinations of band centres and molecular constants have been achieved. A.

535.338.4–31 1474

Ultra violet bands of zinc iodide. I. TIRUVENGANNA RAO, P., AND RAO, K. R. *Indian J. Phys.*, **20**, 49–52 (*April*, 1946).—A brief system of about ten diffuse bands was detected in the region λ3277–3193, and found to have the same final state as the system of Abstr. 2487 (1929). The view is advanced that the two systems are components of an electronic transition $^2\Pi$–$^2\Sigma$ with the $^2\Pi$ interval 370 cm^{-1} [see Abstr. 2548 (1943)]. The occurrence of a third system is also reported. A.

535.338.4–31 1475

Ultra-violet bands of cadmium iodide. RAMASASTRY, C., AND RAO, K. R. *Indian J. Phys.*, **20**, 100–4 (*June*, 1946).—A doublet system due to the electronic transition

$^2\Pi$–$^2\Sigma$, analogous to the halide bands of related molecules, was established in a transformer and in a h.f. oscillatory discharge. The far u.v. system partially recorded by Wieland [Abstr. 2487 (1929)] is extended and the formula calculated. The common final $^2\Sigma$ state is probably the ground state of the molecule. A.

535.338.4–31 1476

Ultra-violet band systems of the mercury iodide molecule. II. RAMAKRISHNA RAO, V., AND RAO, K. R. *Indian J. Phys.*, **20**, 148–53 (*Aug.*, 1946).—[See Abstr. 449 (1946)]. Three new systems are obtained between λ2530 and λ2320, for which vibrational analysis is given. A.

535.34 : 620.179.152 : 537.531 *see Abstr.* 1538–9

535.341 1477

A simplified method of calculating absorbed intensity in photometric experiments. HUNT, R. E., AND HILL, T. L. *J. Chem. Phys.*, **15**, 111–12 (*Feb.*, 1947).

535.341 = 3 1478

Validity of the Lambert–Beer law in bromine vapour. KORTÜM, G., AND MÜLLER, D. *Z. Naturforsch.*, **1**, 439–47 (*Aug.*, 1946) *In German.*—A review of the sources of error occurring in the proving of this law, including a critical discussion of conflicting papers, followed by an account of photo-electric measurements upholding the law in the region of the visible bands of Br_2 vapour up to 100 mm of Hg and 600°C. A. C. M.

535.342 = 3 1479

Absorption by bromine vapour in the banded region in presence of foreign gases. KORTÜM, G., AND MÜLLER, D. *Z. Naturforsch.*, **1**, 637–46 (*Nov.–Dec.*, 1946) *In German.*—Extinction coefficients of Br_2 alone and in presence of A, H_2, CO_2, O_2, HCl, $(CH_3)_2O$ and C_2H_5Cl at 5 461 Å, have been measured by a method previously described [Abstr. 1478 (1947)]. The Lambert–Beer law is obeyed by pure Br_2 and by mixtures of a given composition, but at a defined Br_2-pressure absorption increases with increasing pressure of foreign gas. This effect is at a max. at ~5 350 Å, and is inappreciable at $\lambda > 6\,000$ Å or $< 5\,000$ Å. Pressure broadening alone appears inadequate to explain the results, increases in the transition probability may also be responsible. R. F. B.

535.343 : 523.872 *see Abstr.* 1414

535.343 : 539.181 : 539.152.2 *see Abstr.* 1594

535.343–15 : 532.74 1480

Motions of molecules in condensed systems. III. The infra-red spectra for cyclohexane solid II, solid I, liquid and vapor in the range from 3 to 15 μ. CARPENTER, G. B., AND HALFORD, R. S. *J. Chem. Phys.*, **15**, 99–106 (*Feb.*, 1947).—Measurements similar to those on benzene [Abstr. 2081 (1946)] gave results sharply in contrast, indicating a greater semblance of order in the liquid than in liquid benzene. None of the principles of the earlier paper are contradicted. A.

535.343.32 : 541.18 *see Abstr.* 1666

535.343.32 : 541.651 = 4 1481

Study of the vibration frequencies of certain molecular groups in the near infra-red. BARCHEWITZ, P. *Ann. Phys., Paris* (*Sér.* 11) **18**, 167–89 (*July–Sept.*, 1943) *In French.*—From consideration of vibrational modes and near infra-red spectra various bands are assigned to molecular groupings, e.g. CH_2, CH, OH, NH_2, NH; their appearance in the spectra depends on certain factors, e.g. temperature, dilution, etc. Chelation through hydrogen-bonding is discussed from the standpoint of spectral characteristics. W. R. A.

535.343.4 1482

A new band system (Cordes bands) of iodine. VENKATESWARLU, P. *Proc. Indian Acad. Sci. A*, **24**, 473–9 (*Dec.*, 1946).—Examination of Cordes' work on t absorption spectrum of iodine has revealed a new ba system involving a frequency of 165·1 cm^{-1} in t excited state and locating an electronic level at 51 683 cm above the ground level. The *P–R*, *K–M* bands probab form a different system with a lower electronic level f their excited state. But both systems yield the san dissociation products of the initial states, name $I^-(^1S_0)$ and $I^+(^3P_2)$. The nature of the transitio involved in the two systems is discussed. [See Abstr. 147 (1947)]. W. R.

535.343.4–14 148

Inversion spectrum of ammonia. STRANDBERG, M. W. P KYHL, R., WENTINK, T., JR., AND HILLGER, R. E. *Phy Rev.*, **71**, 326 (*March* 1, 1947).—Precision mesurement to an accuracy of ±50 kc/s were made, and the measure frequencies of 30 lines are compared with those calculate from an empirical formula. $K = 3$ lines do not fit th formula. W. E. D

535.343.4–14 148

Microwave absorption frequencies of $N^{14}H_3$ and $N^{15}H_3$. GOOD, W. E., AND COLES, D. K. *Phys. Rev.*, **71**, 383–4 (*March* 15, 1947).—The frequencies of fifty absorptio lines of these molecules have been measured betwee 19 000 and 26 000 Mc/s to an accuracy better tha 1 in 10^6. W. E. D

535.343.4–15 1485

Infra-red absorption in formaldehyde beyond 10 μ. SINGER, W. E. *Phys. Rev.*, **71**, 531–3 (*April* 15, 1947).—The absorption was studied in the region between 10 μ and 20 μ with a KBr prism spectrometer. Two methods of preparing the gas were used. No appreciable absorption was observed. A.

535.343.4–31 : 523.87 1486

Ultra-violet absorption spectrum of air in the region λλ600–2000. HOPFIELD, J. J. *Astrophys. J.*, **104**, 208–10 (*Nov.*, 1946).—Laboratory observations suggest that the u.v. spectra of celestial bodies may be observed from high altitude rockets through atmospheric "windows" in the regions 1 000–1 300 Å, and 1 700 Å to the visible spectrum. D. L. E.

535.345.1 : 538.615 : 541.182.6 = 5 *see Abstr.* 1667

535.347 = 4 1487

Dichroic films of methylene blue. DEMON, L. *Rev. Opt. (Théor. Instrum.)* **25**, 227–35 (*Sept.–Oct.*, 1946) *In French.*—Under certain conditions, methylene blue crystallizes on amorphous substances in the form of a thin dichroic film. When the crystallization takes place on gypsum or mica a perfect orientation of the crystals forming the film is obtained. The films investigated are of the order of 0·5 microns thick and are strongly dichroic for the yellow but only weakly so for the blue. They can be used in, say, a Laurent polarimeter in place of the nicols. The reflection of light from the films is also discussed. A. H.

535.347 : 541.6 : 535.58 = 4 *see Abstr.* 1504

535.361.1 : 551.593.5 = 5 1488

On the theory of light transmission through clouds. ZANOTELLI, G. *Ric. Sci.*, **12**, 718–31 (*June*, 1941) *In Italian.*—After a review of previous work, absorption and diffusion of direct solar light in a small drop are considered, and the transmission equation for a cloud layer bounded by two parallel planes is established. The solution is written in a simple form and illustrated in graphs. The validity of the simple solution [Abstr. 1731 (1921)] for a solar altitude of 23° is extended. J. A. W.

535.371 : 537.226.1 1489

The influence of irradiation with light on the dielectric properties of ZnS phosphors. DE GROOT, W. *Physica*,

Grav., **12**, 402–4 (*Sept.*, 1946).—Changes of permittivity during irradiation were observed by measuring the change of resonant frequency of a circuit containing a capacitor with the phosphor as dielectric. The light emitted by the phosphor was measured photo-electrically. Some uncalibrated graphs of results are given which in the case of ZnS . Cu are taken to indicate that the change of permittivity is proportional to the number of free electrons. In other cases this does not appear to be so. J. E.

5.371.096 : 537.531 1490

Temperature variation of intensity of luminescence under ray excitation. Bose, H. N. *Indian J. Phys.*, **20**, 21–30 (*Feb.*, 1946).—NaCl, KCl and KBr, with and without Tl, uranyl nitrate, naphthalene and anthracene were studied with a photocell and amplifier between 30 and 200°C. The variation curves were of two types. A.

535.375.5 1491

On the Raman spectra at low temperatures. Benzene derivatives. Sirkar, S. C., and Bishui, B. M. *Indian J. Phys.*, **20**, 111–16 (*June*, 1946).—The spectra of benzalamine, benzyl chloride and benzoyl chloride, solid at −170°C and liquid at room temp., were observed and compared. It is concluded that the first substance is loosely associated when liquid, but polymerizes when solid. The molecules of the other two substances exist as polymeric groups even in the liquid state. A.

535.375.5 1492

Born's theory and the spectrum of light scattering of crystals. Gross, E., and Stehanov, A. *Nature, Lond.*, **159**, 474–5 (*April* 5, 1947).—Second order scattering spectra of Hg 2537 were obtained from crystals of KCl, KBr and NaCl. All showed strong continuous background with small discrete broad maxima. This is in agreement with Born's theory [Abstr. 73 (1946)].

535.375.5 = 3 1493

The present position of Raman effect research. Matossi, F. *Naturwiss.*, **33**, 100–8 (*Aug.* 30, 1946) *In German.*—A general survey, dealing only with vibrational Raman spectra. Comprises principally a review of an article by K. W. F. Kohlrausch [*Hand- und Jahrbuch der chemischen Physik*, **9**, *Abschn. VI* (1943)], but mentions unpublished calculations of degrees of polarization of Raman lines by the author, in which polarizability is assumed to be linearly dependent on applied electric field strength. L. A. W.

535.375.5 : 539.11 *see Abstr.* 1585

535.377 : 537.312.6 1494

Addendum and erratum: The thermoluminescence and conductivity of phosphors. Herman, R. C., and Meyer, R. F. *J. Appl. Phys.*, **18**, 258–9 (*Feb.*, 1947).—See Abstr. 1159 (1947).

535.39 : 535.41 = 3 1495

An investigation of the optical properties of thin evaporated films by means of interference in the total reflection region. Kossel, D. *Z. Naturforsch.*, **1**, 506–8 (*Sept.*, 1946) *In German.*—A discussion is given of the fringes observed when light fell, through the glass, on an evaporated film of refr. index < glass, and due to interference between light internally reflected at the glass-film and film-air surfaces. The refr. index of a film of cryolite, calculated from such observations, was found to have values from 1·05 upwards (cp. 1·364 for bulk) depending on gas pressure during evaporation. Such films have density $< \frac{1}{10}$ normal, and exhibit double refraction and scattering. S. W.

535.393 : 535.87 : 522 = 5 *see Abstr.* 1387

535.41 : 535.82 *see Abstr.* 1507

535.41 : 535.39 = 3 *see Abstr.* 1495

535.417 : 531.715.1 1496

On the planeness of interferometer plates. Rasmussen, E. *K. Danske Vidensk. Selsk. Mat.-fys, Medd.*, **23** (*No.* 3) 18 *pp.* (1945).—Describes a method of applying interference fringes to measure the planeness of Fabry–Perot plates and discusses the accuracy of the method and the dependence of the resolving-power on the planeness. The use of a wedge between silvered plates is advocated for fine-structure observations on intense lines, using Fizeau fringes. A. C. M.

535.417 : 549.623.5 : 548.51 *see Abstr.* 1680

535.42 = 4 1497

Calculation of the diffraction patterns associated with pupils of revolution. Lansraux, G. *Rev. Opt.* (*Théor. Instrum.*) **26**, 24–45 (*Jan.–Feb.*, 1947) *In French.*—A method dealing with the case of waves of radially non-uniform amplitude suffering from spherical aberration of all orders and malfocus. The resulting series are only convenient for numerical calculation providing the asphericity of the wave is small. It is shown that a spherical wave of suitably non-uniform amplitude gives rise to a central disc without diffraction rings. The general formulae yield well-known results as special cases. A number of examples are given. H. H. Hop.

535.42 : 535.317.25 : 535.8 = 3 1498

On the resolving power of the microscope and telescope. Greinacher, H. *Helv. Phys. Acta*, **20** (*No.* 1) 27–32 (1947) *In German.*—Abbé's formulae for the resolving power of the microscope in the cases of perpendicular and oblique illumination are used to obtain a mean resolving power for the case of a full cone of light. This agrees well with the Rayleigh formula for telescopic resolving power. H. H. Hop.

535.42 : 535.8 = 4 1499

Transmission factors and diffracted light. Duffieux, P. M., and Lansraux, G. *Rev. Opt.* (*Théor. Instrum.*) **24**, 151–60 (*July-Sept.*); 215–30 (*Oct.–Dec.*, 1946) *In French.*—Simple forms of pupils are considered as examples of the earlier theory [Abstr. 606 (1946)]. The wave is assumed to be aberration-free, but of non-uniform amplitude. It is shown that, with equal pupil sizes, increased resolution normally entails brighter diffraction rings. The most general transmission factor is discussed, and it is shown that this possesses most of the properties of the function $d(x)$ used in the earlier work. H. H. Hop.

535.43 : 541.182.6 1500

Tyndall spectra, their significance and application. Heller, W., and Vassy, E. *J. Chem. Phys.*, **14**, 565–6 (*Sept.*, 1946).—"Tyndall spectra," i.e. variation of light scattering with wave-length, were determined by measuring the resulting absorption. The wavelength exponent, n, is related to the absorption coefficient, k, by the equation $k = c\lambda^{-n}$ (λ = wavelength, c = constant if light-scattering particles and medium have equal optical dispersion). The $n(\lambda)$ functions of exclusive apparent absorption, $n_a(\lambda)$, and of exclusive true absorption, $n_t(\lambda)$, are characteristically different, and this has been applied to characterize and define chemically the disperse phase of inorganic colloids showing strong light scattering. W. R. A.

535.43 : 541.182.6 1501

The determination of particle sizes from Tyndall spectra. Heller, W., Klevens, H. B., and Oppenheimer, H. *J. Chem. Phys.*, **14**, 566–7 (*Sept.*, 1946).—Aqueous emulsions of polystyrene, polyisoprene, and styrene-isoprene copolymer contain spherical particles,

the sizes of which may be varied by changing conditions, e.g. reaction time, temperature, nature and concentration of emulsifier. These systems have been used in a quantitative determination of particle size from values of the wavelength exponent, n, of scattering. It is reliable for spherical particles, provided that the ratio of refractive indices of disperse phase and dispersive medium lies in the range $1{\cdot}24 \pm 0{\cdot}01$. W. R. A.

535.435 : 541.24 1502

Molecular-weight determination by light scattering. DEBYE, P. *J. Phys. Coll. Chem.*, **51**, 18–22 (*Jan.*, 1947).—Non-absorbing gases or liquids scatter light the main part of which does not change its wavelength, and scattering will increase when the solvent is made inhomogeneous by addition of solute. The author now treats the effect of molecular inhomogeneity as due to spontaneous fluctuations of density, and reveals the intimate connection between light scattering and osmotic pressure whereby the effects of concentration on osmotic pressure and on light scattering can be related to each other. Small and large particles at high dilution and in more concentrated solution are investigated mathematically, and experimental arrangements are described for the determination of molecular weights. H. H. HO.

535.563 : 536.52 = 4 *see Abstr.* 1513

535.568.1 = 4 1503

Critical study of the errors committed in polarimetry in using bare mica plates. RABINOVITCH, J. *Rev. Opt. (Théor. Instrum.)* **25**, 267–74 (*Nov.–Dec.*, 1946) *In French.*—A continuation of earlier work [see Abstr. 2315, 2854 (1946)]. The effect of reducing the reflecting power of the mica surface by means of a thin surface layer is examined, and it is pointed out that without this only feeble birefringence can be handled. The method of crossed measurements is also examined. A. H.

535.58 : 535.347 : 541.6 = 4 1504

Circular dichroism, valency bonds and secondary asymmetry. MATHIEU, J. P. *Ann. Phys., Paris* (*Sér.* 11) **19**, 335–54 (*Oct.–Dec.*, 1944) *In French.*—Absorption curves are drawn, and rotatory dispersion and circular dichroism at visible wavelengths tabulated, for a series of complexes of Co, Ni, and Cu, all of which contain optically active propylenediamine. Analysis of the data indicates that (*a*) the Cotton effect is not necessarily dependent on a dissymmetric arrangement of the co-ordinated groups around the central atom, but can result from vicinal action; (*b*) vicinal action occurs between an active co-ordinated group and the central atom whether the bond joining them is co-valent or co-ordinate; (*c*) the Cotton effect in the absorption band of the central atom is weaker when it results from vicinal action than when it is due to complete dissymmetry of the molecule; (*d*) in the cases examined, secondary asymmetry results from interaction of the dissymmetric molecules co-ordinated in the complex. C. B. A.

535.6 : 628.9 1505

Colour in illuminating engineering. WRIGHT, W. D. *Trans. Illum. Engng Soc., Lond.*, **12**, 1–18 (*Jan.*, 1947).—[Abstr. 1636 B (1947)].

535.66 : 539.213 1506

The use of color and fluorescence indicators for determining the structure of glasses. WEYL, W. A. *J. Appl. Phys.*, **17**, 628–39 (*July*, 1946).—Various systems, the absorption spectra of which are altered by solvent, by chemical changes, and by changes in co-ordination are discussed, and conclusions about the structure of liquids, glasses, and crystals are drawn. The general method is exemplified by reference to many glasses of different thermal history and also by consideration of yellow-fluorescing Zn orthosilicate. W. R. A.

535.8 : 535.317.25 : 535.42 = 3 *see Abstr.* 1498

535.8 : 535.42 = 4 *see Abstr.* 1499

535.82 : 535.41 1507

On a method of increasing contrast in microscopy. MERTON, T. *Proc. Roy. Soc. A*, **189**, 309–13 (*May* 1, 1947).—Thin specimens of low contrast are enclosed between two metallized glass plates. The interferometric device so formed gives high contrast images. A method is also described for measurements of dry particles and fibres, by which, it is claimed, particles of thickness 10^{-5} mm should be detectable. H. H. HOP.

535.87 : 535.393 : 522 = 5 *see Abstr.* 1387

HEAT 536

536.23 : 536.48 : 531.19 = 5 1508

Investigation on the heat conductivity and viscosity in Gentile's statistics, and their possible application to He II. SALVETTI, C. *Ric. Sci.*, **12**, 894–9 (*July–Sept.*, 1941) *In Italian.*—The anomalous behaviour of liquid He below 2·19°K is described, and after a preliminary application of Gentile's intermediate statistics to viscosity and conductivity of a perfect gas, it is confirmed that this theory is well adapted to the solution of problems concerning degenerate Bose-Einstein gases. [See Abstr. 1428 (1947)]. J. A. W.

536.423.1 : 538.69 = 4 1509

On the elevation of boiling point of liquid oxygen under the influence of a magnetic field. VAN ITTERBEEK, A., AND DE BOCK, A. *Ann. Phys., Paris* (*Sér.* 11) **20**, 232–40 (*May–June*, 1945) *In French.*

536.423.4 : 532.6 *see Abstr.* 1438

536.424.1 : 539.893 : 549.211 1510

An experimental contribution to the problem of diamond synthesis. BRIDGMAN, P. W. *J. Chem. Phys.*, **15**, 92–8 (*Feb.*, 1947).—Pressure up to 30 000 kg/cm², and in one case 45 000 kg/cm², has been applied to graphite alone, or to graphite seeded with diamonds, at temperatures above 2 000°C. No detectable transformation of graphite to diamond was found. The rate of inversion of diamond into graphite at a temp. >m.p. of Mo is a function of the pressure, falling to 0 at 30 000 kg/cm². Linear extrapolation would, therefore, indicate reversible transition from graphite to diamond at higher pressures. The graphite formed from diamond under these conditions has the same X-ray structure as ordinary graphite. A.

536.46 1511

Latent energy and after-glow in flame gases. DAVID, W. T. *Nature, Lond.*, **159**, 407 (*March* 22, 1947).—It is suggested that the latent energy (15–25% of heat of combustion) of flame gases resides in stable abnormal triatomic molecules, which are long-lived and quite numerous. This energy is released when the flame gases strike a solid surface, but in isolation would remain for periods of minutes.

536.48 : 531.19 : 536.23 = 5 *see Abstr.* 1508

536.48 : 538.639 : 537.311.31 = 4 *see Abstr.* 1523

536.483 : 621.56 1512

The use of the expansion of gases in a centrifugal field as cooling process. HILSCH, R. *Rev. Sci. Instrum.*, **18**, 108–17 (*Feb.*, 1947). *Z. Naturforsch.*, **1**, 208–14 (*April*, 1946).—The design of a vortex tube of good efficiency is described. The important variables in construction and operation are discussed and data for several tubes under

ious operating conditions are given. Low pressure , 2 to 11 atmos., enters the tube and two streams of one hot and the other cold, emerge at nearly iospheric pressure. The cold stream may be as much 68°C below inlet temperatures. Efficiencies and olications are discussed. A.

.52 : 535.563 = 4 1513

Measurement of colour temperature by the method of ary dispersion. PROISY, P., AND GAUZIT, J. *Rev. Opt. éor. Instrum.*) **26,** 1–23 (*Jan.–Feb.*, 1947) *In French.*— filtering light from a source through two crossed ols and a quartz plate it is possible to make the colour nperature of the emergent beam a function of the gle between the nicols. In particular, by increasing blue/red ratio the colour temperature of the emergent um may be made higher than that of the original urce and so may be matched against a high-temperature urce whose temperature it is desired to measure. The curacy obtainable is discussed. L. G. C.

6.521 1514

The design of barrier-layer photocell pyrometers. ND, H. *J. Sci. Instrum.*, **24,** 95–7 (*April*, 1947).— is note is on the design of industrial pyrometers, and mograms are reproduced which simplify the calcula- ns. A.

6.53 : 530.162 : 621.317.39 1515

Possible use of thermal noise for low temperature rmometry. GERJUOY, E., AND FORRESTER, A. T. *ys. Rev.*, **71,** 375–6 (*March* 15, 1947).—With the paratus now available it is estimated that the lowest easurable temp. is 2°K. With a specially designed ctrometer valve this might be decreased, but the timate temp. measurable would be >0·1°K. W. E. D.

6.62 : 541.144.7 = 4 1516

Study and construction of a microcalorimeter. Applica- on to the yield of a photosynthesis. TONNELAT, J. *Ann. hys., Paris* (*Sér.* 11) **20,** 601–35 (*Nov.–Dec.*, 1945) *In ench.*

6.633 : 534.321.9 *see Abstr.* 1455–7

6.655 : 532.133 : 532.612.4 1517

Power laws of latent heat, orthobaric density, surface nsion and viscosity of liquids. JONES, W. J., AND OWDEN, S. T. *Phil. Mag.*, **37,** 480–9 (*July*, 1946).— mple one-term power laws are given, and agreement ith experiment is good. Numerical values for the arameters in the equations expressing these laws are iven in the region extending about 200 deg. below the ritical temperature for all liquids for which data are vailable. L. S. G.

THERMODYNAMICS 536.7

36.7 : 531.19 = 5 *see Abstr.* 1428

36.71 : 533.75 *see Abstr.* 1446

36.782 : 533.7 *see Abstr.* 1443–4

36.782.08 : 533.7 *see Abstr.* 1445

ELECTRICITY 537

37.122 : 523.877 : 523.852 *see Abstr.* 1408

37.123 1518

Detectability of the negative proton. MCCONNELL, J., ND JÁNOSSY, L. *Nature, Lond.*, **159,** 335–6 (*March* 8, 947).—See Abstr. 785 (1946). Further calculations have hown a reduced probability of production, and escape rom the nucleus after production. Mean free path is <4 cm of Pb, or $\frac{1}{30}$th of the atmosphere, so that detection would be very difficult.

537.212 : 537.228.5 = 3 1519

On a new arrangement for production of very high electrical fields for observation of the Stark effect. GEBAUER, R., AND STEUL, H. *Naturwiss.*, **33,** 186–7 (*Sept.* 30, 1946) *In German.*

537.226 : 621.3.011.5 : 621.315.617 = 3 1520

Dielectric investigations on liquid polymers. GOLDSCHMIDT, R. *Schweiz. Arch. angew. Wiss. Tech.*, **13,** 21–7 (*Jan.*, 1947) *In German.*—[Abstr. 1391 B (1947)].

537.226.1 : 535.371 *see Abstr.* 1489

537.226.3 : 537.226.8 : 621.315.61 1521

The relation between the power factor and the temperature coefficient of the dielectric constant of solid dielectrics. GEVERS, M. *Philips Res. Rep.*, **2,** 79–313 (*Aug.*, 1946).— 49 references are given, and their results tabulated.

537.226.8 1522

Effect of temperature on the permittivity of barium titanate. VAN SANTEN, J. H., AND JONKER, G. H. *Nature, Lond.*, **159,** 333–4 (*March* 8, 1947).—It has been found that the temperature variation of permittivity of rutile and some titanates in the cubic region (above the transformation temperature) can be accounted for on the basis of density variation alone.

537.226.8 : 537.226.3 *see Abstr.* 1521

537.228.4 : 532.74 *see Abstr.* 1439

537.228.5 : 537.212 = 3 *see Abstr.* 1519

ELECTRIC CURRENTS 537.3

537.311.3 : 541.133 = 82 *see Abstr.* 1663

537.311.31 : 538.221 *see Abstr.* 1574

537.311.31 : 538.639 : 536.48 = 4 1523

Measurements of the electrical resistance of films of bismuth under the action of a magnetic field at low temperatures. VAN ITTERBEEK, A., AND DE BOCK, A. *Ann. Phys., Paris* (*Sér.* 11) **20,** 636–46 (*Nov.–Dec.*, 1945) *In French.*—Films of thicknesses between 100 and 300 mμ, prepared by cathode sputtering, were studied in fields up to about 22 000 gauss and at temperatures down to that of liquid O. The results are given graphically; the resistance increases with decreasing temperature and also with increasing magnetic field. At room temperature, values for the increase in a field of 21 400 gauss ranged from 0·4 to 10%. A. W.

537.311.32 : 548.0 1524

Electrical conductivity of molybdenite crystals. DUTTA, A. K. *Nature, Lond.*, **159,** 477 (*April* 5, 1947).—Conductivity along the basal plane is $\sim 10^3\times$ that at right angles. Ohm's law is obeyed at 420°K but not at room temp. At low temps. the conductivity tends to temperature-invariance.

537.311.33 1525

Transition from classical to quantum statistics in germanium semiconductors at low temperature. JOHNSON, V. A., AND LARK-HOROVITZ, K. *Phys. Rev.*, **71,** 374–5 (*March* 15, 1947).—Fermi statistics have been applied to this problem assuming the electrical conductivity of impure semiconductors is due to lattice scattering and scattering by singly charged impurity centres. The former contributes little at low temps. Calculation is in reasonable agreement with experiment. W. E. D.

537.311.62 : 537.312.62 1526

A new method for determining the penetration depth in superconductors. PIPPARD, A. B. *Nature, Lond.*, **159,** 434–5 (*March* 29, 1947).—The inductance of a parallel-wire transmission line varies slightly when the metal becomes superconducting; this can be detected as a

change of resonant frequency of a resonator. The method cannot be used for an absolute determination of penetration depth, but variations with temperature can be investigated with metals, such as Sn, whose normal skin resistance is constant over a range of temperature.

537.312.5 : 621.383.4 1527

Spectral sensitivity of lead sulphide layers. Moss, T. S. *Nature, Lond.*, **159**, 476–7 (*April* 5, 1947).—The long wavelength cut-off was increased from 3 μ to $\sim 4 \cdot 1$ μ by cooling to liquid H temperature. The optimum sensitivity thus achieved gives signal = noise for 8×10^{-10} W/cm^2. The decay time-constant increased by cooling from 14 to 340 μsec.

537.312.6 : 535.377 *see Abstr.* 1494

537.312.62 1528

Magnetic quenching of superconductivity. Sienko, M. J., and Ogg, R. A., Jr. *Phys. Rev.*, **71**, 319 (*March* 1, 1947).—The formula $H_T = A(T_C^{3/2} - T^{3/2})$ is shown to apply to "soft" superconductors, where H_T is the threshold field at temp. T. A is thought to be a universal constant, the reasons given for exceptions obtained with "hard" superconductors being due to irreducible structural inhomogeneities on a micro-scale. W. E. D.

537.312.62 = 3 1529

McLennan's high frequency observations on superconductors. v. Laue, M. *Naturwiss.*, **33**, 92 (*Aug.* 15, 1946) *In German.*—A qualitative discussion of these experiments on the basis of the electrodynamics of superconductors of F. and H. London. H. L.

537.312.62 : 537.311.62 *see Abstr.* 1526

537.363 1530

An electrophoresis apparatus using parabolic mirrors. Swingle, S. M. *Rev. Sci. Instrum.*, **18**, 128–32 (*Feb.*, 1947).

537.363 1531

A modified micro-apparatus for electrophoresis. Douglas, H. W. *J. Sci. Instrum.*, **24**, 103–5 (*April*, 1947).

ELECTRIC DISCHARGES AND RADIATIONS 537.5

537.525.4 1532

Minimum sparking potentials of barium, magnesium, and aluminum in argon. Jacobs, H., and LaRocque, A. P. *J. Appl. Phys.*, **18**, 199–202 (*Feb.*, 1947).—These were found to be $93 \pm \frac{1}{2}$, 123 ± 1, and 155 ± 1 V, respectively. The ratios of electrons emitted from the cathode per bombarding positive ion (γ_m) were found to be $0 \cdot 149 \pm 0 \cdot 001$, $0 \cdot 089 \pm 0 \cdot 033$, and $0 \cdot 045 \pm 0 \cdot 002$ respectively. A relationship is found such that, at a given field per unit pressure, a lower work function or a higher γ_m indicates a lower sparking potential. A graphical method is proposed for predicting the minimum sparking potentials for metals, based upon the values of γ_m or the work function ϕ. A.

537.525.6 : 621.385.18 1533

Effects of magnetic field on oscillations and noise in hot-cathode arcs. Cobine, J. D., and Gallagher, C. J. *J. Appl. Phys.*, **18**, 110–16 (*Jan.*, 1947).—[Abstr. 1521 B (1947)].

537.525.6 : 621.396.615 : 621.385.18 1534

Noise and oscillations in hot cathode arcs. Cobine, J. D., and Gallagher, C. J. *J. Franklin Inst.*, **243**, 41–54 (*Jan.*, 1947).—[Abstr. 1522 B (1947)].

537.525.72 1535

Low-pressure electrical discharges. Gill, E. W. B., and von Engel, A. *Nature, Lond.*, **159**, 404–5 (*March* 22, 1947).—H.f. electrodeless discharges can be started at 0·001 or even 0·0001 mm Hg pressure by quite low voltages provided the wavelength < a certain value determined by the size of the bulb. The starting potential is independent of the gas, and the discharge is probably initiated by secondary emission from the walls of the bulb.

537.527.5 1536

Theory of the high pressure mercury vapour discharge. Francis, V. J. *Phil. Mag.*, **37**, 433–53 (*July*, 1946).—The differential energy-balance equation for the discharge is found and a method for solving it is developed. L. S. G.

537.531 1537

Absolute energies of $K\alpha$-radiation from thick targets of silver. Kirkpatrick, P., and Baez, A. V. *Phys. Rev.*, **71**, 521–9 (*April* 15, 1947).—$K\alpha$-radiation from a thick Ag target bombarded at 40 keV was isolated by Ross filters of 42 Mo and 45 Rh and the total energy measured with a large air-filled ion chamber and found to be $8 \cdot 6 \times 10^{-12}$ erg per electron. This standardizes the curve of intensity v. bombardment voltage measured in arbitrary units up to 180 kV [Abstr. 4556 (1933)]. A quantitative explanation of the curve is developed upon the basis of the absolute cross-section of the Ag atom for K-ionization by electron impact. From this, and the rate of energy loss of the bombardment electron, the absolute energy of Ag$K\alpha$ is calculated, and found to agree with the observed values within the limits of the errors of observation. The mass scattering coefficient of air at $\lambda 0 \cdot 56$Å is found by calculation to be $0 \cdot 244$ cm^{2}g^{-1}. A.

537.531 : 535.34 : 620.179.152 1538

X-ray flicker photometer. Moriarty, C. D. *Gen. Elect. Rev.*, **50**, 39–42 (*Feb.*, 1947).—The photometer is used for comparing the X-ray absorption of two materials, which are placed at opposite windows of an X-ray tube and backed by fluorescent screens. The light from the screens is passed via curved hollow glass pipes, silvered on the outside, to a shutter disc, and thus presented alternately to a multiplier phototube, whose rectified output is a measure of the difference of absorption. Some applications to the testing of materials are described. J. T.

537.531 : 535.34 : 620.179.152 1539

X-ray photometer. Michel, T. C., and Rich, T. A. *Gen. Elect. Rev.*, **50**, 45–8 (*Feb.*, 1947).—Describes a photometer designed for the comparison of the X-ray absorption of two materials. X-rays are "chopped" and passed through one or other of the two materials alternately and fall upon one or other half of a fluorescent screen. The light from the screen is detected by a phototube, the a.c. component of whose output is amplified and rectified. Zero balance is obtained by the insertion of a calibrated wedge into one of the X-ray beams, and the difference in absorption between the two materials is thereby indicated. J. T.

537.531 : 535.371.096 *see Abstr.* 1490

537.533 : 535.215 1540

Photo-electric emission from a rough surface. Bradner, H. *Phys. Rev.*, **71**, 269–70 (*Feb.* 15, 1947).—The Fowler-DuBridge theory [Abstr. 3249 (1933)] of the energy distribution of photo-electrons is modified to apply to the case of a rough surface, which corresponds more closely to the usual experimental conditions. W. E. D.

537.533.9 1541

An effect of electron bombardment upon carbon black. Watson, J. H. L. *J. Appl. Phys.*, **18**, 153–61 (*Feb.*, 1947).—A significant change is reported in mean particle size

d shape characteristics of carbon black while under amination in electron microscopes. Examples are en in graphical form to illustrate expected variations mean particle size with continued bombardment at rmal focusing intensities. The effect is observed in ier materials and suggestions are made for minimizing A.

7.534 : 615.849 *see Abstr.* 1689

7.534 : 621.385.82 1542

Ion beams in high voltage tubes using differential mping. LAMAR, E. S., AND BUECHNER, W. W. *J. pl. Phys.*, **18**, 22–7 (*Jan.*, 1947).—[Abstr. 1530 B 947)].

7.534.74 1543

Proton-proton scattering at 8 MeV. WILSON, R. R., D CREUTZ, E. C. *Phys. Rev.*, **71**, 339–48 (*March* 15, 47).—A coincidence method of studying the scattering protons by protons has been developed and applied 8 MeV protons obtained from a cyclotron. Relative easurements of the scattering cross-section as a function the angle of scattering are most consistent with eoretical cross-sections calculated, on the assumption *S*-wave scattering only. However, the accuracy of e experiment is not great enough definitely to exclude wave scattering effects, positive or negative. The perimental value of the scattering cross-section $7 \pm 0{\cdot}1 \times 10^{-25}$ cm² agrees with the theoretical value 80×10^{-25} within the experimental uncertainty. A.

7.534.74 1544

Proton-proton scattering at 10 MeV. WILSON, R. R. *ys. Rev.*, **71**, 384–5 (*March* 15, 1947).—Experimental sults are reported which can be explained by pure -wave scattering or a mixture of *S* and repulsive *P*, cording to the shape of the potential well assumed, but ot by any mixture of *S* and attractive *P*. W. E. D.

37.534.74 : 615.849 1545

Range, straggling and multiple scattering of fast protons. ILSON, R. R. *Phys. Rev.*, **71**, 385–6 (*March* 15, 1947).—ormulae and calculations are reported, and the limitaons of their application discussed. They have been plied to radiological purposes [see Abstr. 1689 (1947)]. he range of 150 MeV protons in tissue is given as 5 cm, the range straggling 0·3 cm, and the transverse read 0·6 cm. Their range in air is 150 m, so there is eat danger of lethal doses from scattered rays.

37.542 1546

Spread of discharge in Geiger counters. CRAGGS, J. D., ND JAFFE, A. A. *Nature, Lond.*, **159**, 369–70 (*March* 15, 947).—A counter with segmented cathodes was used, nd coincidences between the irradiated end segment, nd segments further down the tube, were measured, the ntervening segments being held just below their counting resholds. Considerable spread was observed even with fast" fillings. It is suggested that photo-emission at the thodes is a more important mechanism than photoonization in the gas.

37.542 1547

Mass spectroscopic analysis of the polyatomic gases in fast counter. FRIEDLAND, S. S. *Phys. Rev.*, **71**, 377–8 (*March* 15, 1947).—Experiments verify the suggestion of Korff and Present [Abstr. 2068 (1944)] that the quenching organic molecules are broken up during counter operation into lighter non-quenching molecules, and examination of the counter gas mixture after use reveals that the final constituents are mainly CO_2, CO and CH_4. W. E. D.

37.542 = 3 1548

On the discharge formation in alcohol-filled counter tubes. ALDER, F., BALDINGER, E., HUBER, P., AND METZGER, F. *Helv. Phys. Acta*, **20** (*No.* 1) 73–95 (1947) *In German.*—As a test of the theory developed, measurements are made of light absorption in the filling and propagation velocity of discharge using (*a*) an electronic analogue of Fizeau's light velocity determination, and (*b*) measurements on current impulse shapes using c.r.o. technique. Results agree within limits of exptl. error. With const. press. (A, ~64 mm Hg + alcohol, ~16 mm Hg) the propagation velocity (~8×10^6 cm/sec) increased almost linearly with tube voltage (~1 100 V); with const. voltage, the propagation velocity declined with increasing alcohol pressure. T. E.

537.562 : 539.132 *see Abstr.* 1588

537.581 = 3 1549

Measurement of the electron emission from carbon, silicon and silicon carbide. BRAUN, A., AND BUSCH, G. *Helv. Phys. Acta*, **20** (*No.* 1) 33–66 (1947) *In German.*—The emission consts. of C and Si were determined in a vacuum oven, the sample being heated by radiation. Special attention (theoretical and practical) is given to the semi-conductor SiC. T. E.

537.582 : 541.134 *see Abstr.* 1665

COSMIC RAYS 537.591

537.591 1550

A proposed focusing cosmic-ray telescope. HARRIS, W. T. *Phys. Rev.*, **71**, 310–13 (*March* 1, 1947).—A magnetic lens which will focus charged particles entering its aperture parallel to the axis can be constructed in the form of a toroidal winding. For an air or iron core toroid, the cross-section of the winding is parabolic. If partial iron filling is used, trapezoidal or rectangular cross-sections may be employed. The focal length is proportional to the particle momentum, and hence the telescope is also a spectrograph. By using coincidence counters and anticoincidence guard counters for observations, a collimating tube effect can be obtained. Charged and uncharged components can be studied separately with a two-lens installation in a shaft. A.

537.591 = 4 1551

Studies of cosmic rays. GRIVET, T. *Ann. Phys., Paris* (*Sér.* 11) **18**, 73–134 (*April–June*, 1943) *In French.*—The intensity and angular distribution of the hard and soft components of cosmic rays, and the transition properties and geometry of showers were studied in 5 laboratories covering depths below sea level of from 0 to 66 m water equivalent. J. G. W.

537.591 : 539.172 = 3 1552

Nuclear disintegrations and slow mesons in cosmic rays. STEINMAURER, R., AND V. RÜLING, J. *S. B. Akad. Wiss. Wien*, **151**, *Abt. IIa* (*Nos.* 5–6) 159–68 (1942) *In German.*—A survey is given of heavily-ionising tracks obtained in 2 000 expansions of a long-sensitive cloud chamber in a field of 700 gauss at altitude 2 300 m. J. G. W.

537.591 : 539.18 *see Abstr.* 1634

537.591.1 = 5 1553

On the soft/hard ratio of cosmic radiation at sea level. PATANÈ, S. *Ric. Sci.*, **12**, 426–30 (*April*, 1941) *In Italian.*—Using triple coincidences, the variation of the *s*/*h* ratio with barometric pressure was determined in open air and under a 160 g/cm² shield. At 760–765 mm $s/h = 0{\cdot}2576 \pm 0{\cdot}0197$, at 750–755 mm, $s/h = 0{\cdot}3060 \pm 0{\cdot}0185$ in open air. Under shield, at 750–755 mm, $s/h = 0{\cdot}0799 \pm 0{\cdot}0146$, at 764–769 mm $s/h = 0{\cdot}0551 \pm 0{\cdot}0186$. J. A. W.

537.591.1 = 5 1554

The proton character of primary cosmic radiation. COCCONI, G. *Ric. Sci.*, **12**, 936–9 (*July–Sept.*, 1941) *In*

Italian.—Reasons are given for assuming that primary cosmic radiation at the boundary of the atmosphere consists of protons, which generate mesons by collision with nuclei in the upper atmosphere; these, in turn, disintegrate into electrons and neutrinos, multiplying in cascade processes. Slower mesons in the upper layers disintegrate into low-energy electrons. J. A. W.

537.591.1 = 5 1555

On the electronic component of cosmic rays and the theory of multiplying processes. BERNARDINI, G., AND CACCIAPUOTI, B. V. *Ric. Sci.*, **12**, 981–92 (*Oct.*, 1941) *In Italian.*—From two series of observations at Rome (50 m) and one at Pian Rosà (3 480 m) with counter arrangements in double, triple and quintuple coincidence, it is concluded that the electronic intensity ratio $E_{3500}/E_0 = 6$, the meson ratio $M_{3500}/M_0 = 2$. If R_0 = electronic residue at sea level and R = primary electronic intensity at 3 500 m, $R/R_0 = 9$ and, assuming a mean life of 2–3 μsec, $R_0 \simeq I_0 + D_0$, where I_0 = secondary electron intensity by collision and D_0 = secondary disintegration intensity. [See Abstr. 243 (1939)]. Apparatus is described and results tabulated and graphed. J. A. W.

537.591.1 = 5 1556

On the very soft component of cosmic radiation in oblique direction. BALLARIO, C., AND BENINI, M. *Ric. Sci.*, **12**, 1141–5 (*Nov.*, 1941) *In Italian.*—Using a telescope arrangement, at 45° to the vertical, with 2 counters in coincidence and 4 in anticoincidence, the total number of 5–50 MeV photons was 1·74 per min, whereas the number of electrons was 0·49 per min. J. A. W.

537.591.1 = 5 1557

Contribution to the study of the ultra-soft component of cosmic radiation. OCCHIALINI, G. *Ric. Sci.*, **12**, 1193–5 (*Nov.*, 1941) *In Italian.*—The energy spectrum determined with 2 counters (telescope vertical) is graphed. Defining the ultra-soft component as that absorbed in 4–25 mm Al, this component constitutes 16% of the total radiation, and is isotropic. [Abstr. 4295 (1939)]. J. A. W.

537.591.1 = 5 1558

On the positive excess in cosmic radiation. BERNARDINI, G., CONVERSI, M., PANCINI, E., AND WICK, G. C. *Ric. Sci.*, **12**, 1227–43 (*Dec.*, 1941) *In Italian.*—With a telescopic arrangement of 3 counters in coincidence, with 4 interposed magnetized Fe sheets acting as a convergent or divergent cylindric lens, according to the sign of the particles and the direction of magnetization, a series of observations at Rome and at Cervinia gave results which point to an excess of 20%. The theory of the instrument and of the method of calculation is given in detail. J. A. W.

537.591.1 : 539.18 = 3 *see Abstr.* 1635

537.591.1 : 539.18 = 5 1559

Determination of meson mean life between 2 000 and 3 500 m above sea level. CACCIAPUOTI, B. N., AND PICCIONI, O. *Ric. Sci.*, **12**, 874–82 (*July–Sept.*, 1941) *In Italian.*—Two series of observations at Cervinia (2 050 m) and one at Pian Rosà (3 460 m) were made with counter arrangements using triple and quadruple coincidences with varying thickness of Pb screens. The mean life-time was 2·7 ± 0·5 μsec; this value is compared with previous results, and the theory of the method used is given. J. A. W.

537.591.1 : 539.18 = 5 *see Abstr.* 1636

537.591.15 1560

The lateral extension of Auger showers. SKOBELTZYN, D. V., ZATSEPIN, G. T., AND MILLER, V. V. *Phys. Rev.*, **71**, 315–17 (*March* 1, 1947).—By observing fourfold coincidences between two pairs of counters, random coincidences were reduced to a low enough value for true coincidences to be detected when the separation of the pairs was as high as 600 m. The variation with separation is at variance with the theory of shower extension, and the suggestion is made that the coincidences are due to simultaneously produced, but diverging, high energy particles.

537.591.15 1561

Presence of a penetrating component in extensive showers in the atmosphere. MURA, A., SALVINI, G., AND TAGLIAFERRI. *Nature, Lond.*, **159**, 367–8 (*March* 15, 1947).—Experiments comparing the numbers of 5- and 7-fold coincidences of an arrangement of counters, with different thicknesses of Pb and Fe, gave confirmation of the existence of penetrating particles. They are distinguished from electrons and photons by their high penetrating power, low multiplication while passing through thick Pb and Fe plates, and different variation of absorption with atomic number of absorber.

537.591.15 1562

Cosmic ray bursts in an unshielded chamber and under one inch of lead at different altitudes. BRIDGE, H., AND ROSSI, B. *Phys. Rev.*, **71**, 379–80 (*March* 15, 1947).—The conclusions drawn are that all cosmic ray electrons and photons do not arise from the decay of ordinary mesons; and that star-producing radiation and the electron-photon component are both in equilibrium with a common parent radiation. W. E. D.

537.591.15 = 4 1563

Production and nuclear interaction of mesons. DAUDIN, J. *Ann. Phys., Paris* (*Sér.* 11) **19**, 110–16 (*April–June*, 1944) *In French.*—Shower particles were observed in a cloud chamber under screening up to 12 cm Pb at 2 300 m altitude. The groups—showers of penetrating particles (mesons), cascades, and explosions with the emission of heavy particles—are not distinct categories, and combinations of these types occur. J. G. W.

537.591.15 = 4 1564

Studies of cosmic ray showers. DAUDIN, J. *Ann. Phys., Paris* (*Sér.* 11) **18**, 145–66 (*July-Sept.*); 217–57 (*Oct.–Dec.*, 1943) *In French.*—A detailed discussion is given of cosmic ray showers, their analysis and the statistical problems of counter experiments, with particular reference to extensive air showers (Auger showers). Observations on the latter are given; and the distribution and spectrum of low-energy electrons, the nature of condensations of energetic electrons and photons, and the presence of penetrating particles which are probably mesons, are treated. J. G. W.

537.591.15 = 4 1565

The penetrating and shower-transmitting components in Auger showers. DAUDIN, J. *Ann. Phys., Paris* (*Sér.* 11) **20**, 563–84 (*Nov.–Dec.*, 1945) *In French.*—A discussion of the relation between the penetrating particles (estimated at ~2% of all ionizing particles) and the electron-photon component in extensive air showers is given, and the relation between energy spectrum and absorption in Pb of the electrons and photons is studied. [See also Abstr. 1564 (1947)]. J. G. W.

537.591.15 = 5 1566

Strongly ionizing particles in cosmic-ray showers. COCCONI, G. *Ric. Sci.*, **12**, 940–1 (*July–Sept.*, 1941) *In Italian.*—A photograph is shown of a pair of strongly ionizing particles, obtained in a coincidence record of normal electron showers in 60 cm Al, the particles being formed in a 20 mm Al screen in the camera. J. A. W.

.591.2 : 539.185.9 1567

Determination of the energy and momentum of fast trons in cosmic rays. LATTES, C. M. G., AND CHIALINI, G. P. S. *Nature, Lond.*, **159**, 331–2 (*March* 1947).—Energy and momentum analysis of a 3-track t found in a boron-loaded photographic emul- n exposed at 2 800 m indicated a disintegration $+ n \rightarrow \alpha + \alpha + H^3$ with an incident neutron energy 45 ± 8·5 MeV. The reliability and accuracy of this thod of measuring neutron energies is discussed.

7.591.3 = 5 1568

On the cosmic ray absorption curve underground. TANÉ, S., AND PANEBIANCO, B. *Ric. Sci.*, **12**, 883–6 *ly–Sept.*, 1941) *In Italian.*—Using a previously scribed method [see Abstr. 1553 (1947)] a series of servations was made under a gallery of 97 m water uivalent. Eliminating shower effects, the soft/hard nponent ratio was 0·134 ± 0·0203. The absorption rve is shown. J. A. W.

7.591.3 : 539.18 = 5 *see Abstr.* 1637

7.591.5 = 5 1569

On the barometric effect of the electron component of smic rays. COCCONI, G., AND TONGIORGI, V. *Ric. Sci.*, , 664–5 (*May*, 1941) *In Italian.*—[Abstr. 1247 (1947)]. sing quadruple coincidence counting, eliminating lateral ower effects, the variation of the electron/meson ratio th atmospheric pressure was observed and a variation efficient of −0·16 found. J. A. W.

7.591.8 1570

Non-primary cosmic ray electrons above the earth's mosphere. PERLOW, G. J., AND SHIPMAN, J. D., JR. *ys. Rev.*, **71**, 325–6 (*March* 1, 1947).—In a V-2 rocket periment up to 70 miles many soft electrons were tected, and the possibility is considered of these being ue to an upward radiation from the lower atmospheric yers. W. E. D.

7.591.8 : 539.172 *see Abstr.* 1621

7.591.8 : 539.172 = 5 *see Abstr.* 1622

MAGNETISM 538

8.114 1571

Ferromagnetism at very high frequencies. I. Magnetic on at 200 Mc. JOHNSON, M. H., RADO, G. T., AND ALOOF, M. *Phys. Rev.*, **71**, 322–3 (*March* 1, 1947).— $\mu_1 - i\mu_2$ is the complex permeability, it is shown that $\chi/(\mu_1 - 1)$ is practically constant for fields up to 500 ersted with a value of about 0·15, and that at 200 Mc/s e relaxation time for magnetization by rotation of the omain spins is about 10^{-10} sec. W. E. D.

38.221 = 3 1572

The smallest ferromagnetic domains in iron. KÖNIG, . *Naturwiss.*, **33**, 71–5 (*Aug.* 15, 1946) *In German.*— hin films of Fe deposited by evaporation were amined for ferromagnetic properties by observa- on of the Faraday effect on light transmitted through em. Films containing particles smaller than 10–12 Å ere not ferromagnetic, and it is concluded that this is e limiting size of ferromagnetic domains in iron. A. E. D. B.

38.221 = 4 1573

Magnetic properties of haematite powder. Effect of rain size. CHEVALLIER, R., AND MATHIEU, S. *Ann. hys., Paris* (*Sér.* 11) **18**, 258–88 (*Oct.–Dec.*, 1943) *In rench.*

38.221 : 537.311.31 1574

Interpretation of anomalous Larmor frequencies in rromagnetic resonance experiment. KITTEL, C. *Phys. ev.*, **71**, 270–1 (*Feb.* 15, 1947).—Griffiths [Abstr. 340 (1947)] found that in ferromagnetic resonance experiments the resonance frequencies were 2 to 6× the Larmor frequencies for electron spin. It is shown that, owing to the dynamic coupling caused by the demagnetizing field, the Larmor frequency should be calculated for a field of effective strength $(BH)^{\frac{1}{2}}$ rather than H. The theory given accounts well for the experimental results. W. E. D.

538.221 : 539.22 1575

A new method of studying the structure of alloys by magnetic analysis. HOBSON, P. T. *Nature, Lond.*, **159**, 436 (*March* 29, 1947).—Irregularities observed in the oscillogram of dJ/dt (J = magnetic intensity) of a ferromagnetic wire under a cyclic field are attributed to local inhomogeneities of structure with differing coercivities.

538.222 : 548.7 1576

Magnetic studies on nickel ions in crystals. MOOKHERJI, A. *Indian J. Phys.*, **20**, 9–20 (*Feb.*, 1947).—Measurements were made of the anisotropies and the principal magnetic susceptibilities of a number of crystalline Ni salts, and the contributions of the constituent paramagnetic units worked out. The constants of the crystalline electric field are calculated [Abstr. 1213 (1933)] and the relative contributions of the different terms to the effective magnetic moments in different directions of the paramagnetic units discussed. Finally the magnetic anisotropy is discussed in relation to the Stark splitting due to the crystalline electric field. A.

538.224 : 539.15 1577

A calculation of the diamagnetic susceptibility of Li^+, Na^+ and K^+ from Thomas-Fermi charge distribution. OM PARKASH SHARMA. *Indian J. Phys.*, **20**, 44–8 (*April*, 1946).—The importance of the "electron subtraction" method for calculating the finite ion-radius is pointed out. Using the values of ρ_{ion} thus calculated graphically the values of χ_M for Li^+, Na^+ and K^+ are then calculated. The results agree well with experimental values. A.

538.224 : 539.4.016.2 1578

Temperature-dependence of magnetic susceptibility of annealed and cold-worked copper. HUTCHISON, T. S., AND REEKIE, J. *Nature, Lond.*, **159**, 537–8 (*April* 19, 1947).—Very pure Cu was used, and evidence is given to show that it had negligible Fe content. Cold working changed the susceptibility at 90°K from −0·092 to −0·078, and the variation over the range 90 − 630°K from 21% to 12%. An explanation is briefly suggested.

ELECTROMAGNETISM . ELECTRODYNAMICS 538.3/.5

538.56 1579

Relative directions of the electric and magnetic vectors in electromagnetic waves *in vacuo*. JAPOLSKY, N. S. *Nature, Lond.*, **159**, 580 (*April* 26, 1947).—It is pointed out that the time-derivative of $\vec{E}$ is always perpendicular to $\vec{B}$, but not necessarily the vector itself, if it is rotating.

538.56 : 530.12 = 4 1580

On certain results in relativistic electromagnetism. DE BEAUREGARD, O. C. *Ann. Phys., Paris* (*Sér.* 12) **1**, 522–37 (*Sept.–Oct.*, 1946) *In French.*—Amplifies the discussion of certain results given in earlier notes, viz., (*a*) the definition of force as a covariant antisymmetric tensor, from purely electromagnetic considerations, (*b*) the density of the conduction current and Joule heat, (*c*) the Maxwell-Minkowski tensor. An analogue of the latter and the electromagnetic spin and couple densities are also discussed. [See also Abstr. 2870, 2953 (1946), 34 (1947)]. V. C. A. F.

538.566 : 621.392.1 1581

Quasi-stationary field theory and its application to diaphragms and junctions in transmission lines and wave guides. MACFARLANE, G. G. *J. Instn Elect. Engrs, Pt IIIA*, **93** (*No.* 4) 703–19 (1946).—[Abstr. 1553 B (1947)].

538.569.4 : 621.317.78.029.6 1582

Thermal and acoustic effects attending absorption of microwaves by gases. HERSHBERGER, W. D., BUSH, E. T., AND LECK, G. W. *RCA Rev.*, **7**, 422–31 (*Sept.*, 1946).—15 gases strongly absorb microwaves. Measurement techniques are described and the theoretical interpretation of the observed absorption for some of the simpler molecules is given. Thermal conversion is shown by confining an absorbing gas in a cavity resonator which communicates with a U-tube. A 12-in deflection of the U-tube column is obtained when the average input power is 10 W. Acoustic conversion is shown by exposing a gas-filled balloon to a modulated microwave field. The absorbing gas may be confined in an organ pipe closed at one end by a piezo-electric crystal. This organ pipe is resonant electromagnetically to the impressed microwave frequency and acoustically to the modulation frequency; it has a square law response and detects 10 mW. A.

MAGNETIC EFFECTS 538.6

538.615 : 523.87 *see Abstr.* 1413

538.615 : 535.338.3 = 4 *see Abstr.* 1469

538.615 : 535.345.1 : 541.182.6 = 5 *see Abstr.* 1667

538.639 : 536.48 : 537.311.31 = 4 *see Abstr.* 1523

538.69 : 536.423.1 = 4 *see Abstr.* 1509

538.712 : 550.38 = 5 *see Abstr.* 1683

ATOMIC AND MOLECULAR STRUCTURE 539

539 1583

Release of information on atomic energy. *Nature, Lond.*, **159**, 411–12 (*March* 22, 1947).—A list of titles of British declassified reports is given.

539 : 621.318.572 1584

A pulse analyser for nuclear research. FREUNDLICH, H. F., HINCKS, E. P., AND OZEROFF, W. J. *Rev. Sci. Instrum.*, **18**, 90–100 (*Feb.*, 1947).—This instrument analyses the electrical pulses from an ionization chamber into a number of classes according to their amplitude and hence produces an energy spectrum of the particles. Every pulse is counted; some indication of the final result appears while the experiment is in progress; the number of pulses within a certain amplitude range is recorded by a mechanical counter. A brief survey of five different pulse analysers is given, and described in detail. It has 20 identical channels, each recording the pulses within an amplitude range that can be varied from 0·1 to 10 V. A.

539.11 : 535.375.5 1585

Hydrogen bonding in ice. MARTIN, A. E. *Nature, Lond.*, **159**, 403–4 (*March* 22, 1947).—See Abstr. 652 (1947). Born's treatment is criticized, and relevant references are quoted.

539.13 1586

Binding energy of the positronium molecule. HYLLERAAS, E. A., AND ORE, A. *Phys. Rev.*, **71**, 493–6 (*April* 15, 1947).—A system of two electrons and two positrons is shown to possess dynamic stability. The variational calculation performed leads to a binding energy of at least 0·11 eV for this cluster. The approximate wave function which yields this value depends on the four electron-positron distances only. Neglect of the two distances between particles of the same kind permits a essential mathematical simplification which might be interest in other problems.

539.132 : 533.15 = 3 158

Separation of *o*-H_2 and *p*-H_2 by thermal diffusio in a separation tube. SCHÄFER, K., AND CORTE, H *Naturwiss.*, **33**, 92–3 (*Aug.* 15, 1946) *In German.*—O the basis of a new thermodynamic-statistical considera tion, which connects thermal diffusion with therma conductivity, separability of ortho- and para-hydrogen i predicted. The effect is verified experimentally, giving a enrichment of *o*-H_2 at the top of a Clusius–Dickel tube The separation factor increases with increasing *o*-H concentration, which is in agreement with the new theory. H. L.

539.132 : 535.338.4 *see Abstr.* 1471–2

539.132 : 537.562 158

Metastable ion transitions in the mass spectra of the monochloropropenes. DIBELER, V. H., WISE, C. E., JR. AND MOHLER, F. L. *Phys. Rev.*, **71**, 381–2 (*March* 15 1947).—The loss of the Cl atom from the monochloro propenes after traversing the accelerating field of a mass spectrograph is verified by the position and relative abundance of the Cl^{35} and Cl^{37} isotopes thus produced W. E. D.

539.133 : 535.338.4 158

On the dissociation energy of CO. HAGSTRUM, H. D *Phys. Rev.*, **71**, 376–7 (*March* 15, 1947).—Assuming the dissociation energy of 9·6 eV for CO as obtained by electron collision experiments [Abstr. 877 (1941)] a possible scheme is proposed to account for the results o the band spectrum. W. E. D.

539.133 : 535.338.4–15 *see Abstr.* 1473

539.15 159

Electron affinity of positronium. HYLLERAAS, E. A *Phys. Rev.*, **71**, 491–3 (*April* 15, 1947).—By use of the variational method as previously applied to the mathe matically similar problem of the negative atomic hydroge ion, the energy of a compound of two electrons and one positron has been calculated. The resulting (third approximation) value of roughly 0·19 eV binding energy of this system with respect to dissociation into a free electron and a system of one electron and one positron corresponds to the value already found by Wheeler. On the basis of higher approximations obtained for H^-, the exact binding energy of the tri-electron has been estimated to be 0·203 eV. A.

539.15 : 538.224 *see Abstr.* 1578

539.152.1 159

A classical model for the nucleus. WINANS, J. G. *Phys Rev.*, **71**, 379 (*March* 15, 1947).—A spherical model is assumed with protons confined to the outside. The implications of the model are discussed. W. E. D.

539.152.2 159

Magnetic moment of the triton. ANDERSON, H. L., AND NOVICK, A. *Phys. Rev.*, **71**, 372–3 (*March* 15, 1947).—The ratio of the magnetic moment of the triton to that of the proton was measured by the nuclear induction method and found to be 1·06666 ± 0·00010. W. E. D.

539.152.2 159

Spin and magnetic moment of tritium. BLOCH, F. GRAVES, A. C., PACKARD, M., AND SPENCE, R. W. *Phys Rev.*, **71**, 373–4 (*March* 15, 1947).—A nuclear induction experiment gives a value of ½ for the spin of the triton and a positive value, viz. 1·067 ± 0·001, for the ratio of its magnetic moment to that of the proton. W. E. D.

9.152.2 : 535.343 : 539.181 1594
The molecular beam magnetic resonance method. The diofrequency spectra of atoms and molecules. KELLOGG, B. M., AND MILLMAN, S. *Rev. Mod. Phys.*, **18**, 323–51 uly, 1946).—The article summarizes the results achieved the method since its introduction [Abstr. 2090 (1939)]. e values of nuclear moments and spin are listed, and e hyperfine structure separation of ground-state alkali oms, with discussion of most of them. A bibliography 69 items is included.

9.155.2 1595
An a.c. operated mass spectrometer for isotope abundce measurements. GRAHAM, R. L., HARKNESS, A. L., D THODE, H. G. *J. Sci. Instrum.*, **24**, 119–28 (*May*, 47).—This compact and portable instrument of the r type employs a universal gas-type ion source which y readily be replaced with a furnace or filament-type n source for use with solids. The electronic units erate from unstabilized a.c. and do not require tteries; they are described in detail. Isotopic comnents present to the extent of 1 part in 100 000 can be tected, with a resolving power better than 1 in 130. A.

ADIOACTIVITY . NUCLEAR DISINTEGRATION NUCLEAR PARTICLES 539.16/.18

9.16 : 778.3 1596
Radioactive track counts in photographic plates. ODA, E. *J. Sci. Instrum.*, **24**, 136–8 (*May*, 1947).—e possibilities of the absolute determination, by radiotive track-count methods using "loaded" photographic ates, of decay constants, nuclear reaction cross-sections, clear particle fluxes and concentrations of radioactive dies are discussed. Experiments are described showing e influence of conditions of loading on the amount of aterial absorbed by the emulsion, taking U as reprentative. It is found that the velocity of the uptake creases rapidly with time of immersion. The quantity sorbed is a nearly linear function of the concentration the bath over a range 3·3–0·01%, but at lower conntrations absorption is relatively more efficient. In utral solutions absorption is larger than in slightly acid lutions, possibly owing to hydrolysis. High conntrations (~20–50%) of a neutral salt (ammonium rmate) depress the uptake, probably owing to deelling of the gelatin. Lead ion in up to 80-fold excess es not displace uranyl ion in the emulsion. A.

9.16.08 1597
Use of a cyclotron to detect short period activities. ASSELS, J. M., AND LATHAM, R. *Nature, Lond.*, **159**, 7 (*March* 15, 1947).—An automatic electronic switchg device, operated by a master oscillator whose equency can be adjusted between 1 c/s and 100 kc/s, itches on the cyclotron for a short burst, and then nnects a Geiger counter near the target to successive cording sets. The He^6 ½-period was correctly deterined as 0·87 ± 0·06 sec, and no shorter-period tivities of comparable strength from the Be(*n*) reaction ere observed down to 10^{-3} sec.

9.16.08 = 5 1598
The Wilson chamber of the Institute of Physics of the niversity of Milan. POLVANI, G. *Ric., Sci.*, **12**, 410–20 pril, 1941) *In Italian.*—An illustrated description of a cm dia. × 5 cm deep chamber with special rapidpansion devices and stereoscopic photographic recordg. Operation is described and records are reproduced. J. A. W.

9.16.08 = 5 1599
Automatic apparatus for measurement of radioactivity. TRABACCHI, G. C. *Ric. Sci.*, **12**, 824–9 (*July–Sept.*, 1941) *In Italian.*—An illustrated description (diagrams and photographs) of continuously-recording apparatus for evaluating the rate of decay of radioactive substances. The zero error of the electrometer is eliminated, and the measurements are reduced to records of time taken by the needle to swing through a given angle. J. A. W.

539.163 1600
Radioactive isotopes of Re, Os, and Ir. GOODMAN, L. J., AND POOL, M. L. *Phys. Rev.*, **71**, 288–93 (*March* 1, 1947).—Two new radioactive isotopes have been found: Os^{185} produced by a Re(*d*, 2*n*) reaction; and Ir^{190} produced by Ir(*n*, 2*n*) and by Os(*d*, *n*) reactions. The values of ½-life, β- and γ-ray energies are given. A.

539.163 1601
Coincidence experiments on Ga^{72}. MITCHELL, A. C. G., JURNEY, E. T., AND RAMSEY, M. *Phys. Rev.*, **71**, 324–5 (*March* 1, 1947).—From measurements on the β- and γ-radiation, a nuclear energy level scheme is proposed. W. E. D.

539.163 = 4 1602
A contribution to the study of nuclear isomerism: a study, by the absorption method, of the internal conversion radiation associated with the isomeric transition of Br^{80}. BERTHELOT, A. *Ann. Phys., Paris*, **19**, 117–49 (*April–June*); 219–70 (*July–Sept.*, 1944) *In French.*—In Part I a general description is given of the phenomenon of nuclear isomerism and of the methods of producing the metastable isomers and analysing their radiations. The importance of internal conversion is stressed. The theoretical treatments of the problem, by quantum mechanics and also through the liquid drop model, are discussed. An oscillating liquid-drop model is shown to lead to results most nearly in line with experiment. The theoretical dependence of the internal conversion coefficient upon the energy, order, and quality (electric or magnetic) of the multipole radiation is set out. In Part II, after a review of experiments by other authors, a description is given of a coincidence counting arrangement by means of which the electron energy groups in the radiation from Br^{80} were analysed, using absorbing foils of Al from 0·10 to 7·27 mg/cm². Four groups, of energies 47·2, 35·5, 23·6 and ~11 keV, were identified (this last being attributed to Auger effect). The three higher energy groups are ascribed to *K* and *L* conversion of two γ-rays of 49 keV and 37 keV respectively, these being emitted in cascade within the resolving time (2·3 μsec) of the coincidence circuit. The γ-ray of 49 keV is totally converted: $\alpha_K = 0{\cdot}88$, $\alpha_L = 0{\cdot}12$. For the 37 keV quantum, $\alpha_K = 0{\cdot}34$, $\alpha_L = 0{\cdot}05$. From these values it is concluded that the 49 keV transition is magnetic octupole, and determines the period of the complete isomeric change. The subsequent 37 keV transition is a magnetic dipole process. A. P. F.

539.163.1 1603
Neutron induced activities in lutecium, ytterbium and dysprosium. INGHRAM, M. G., HAYDEN, R. J., AND HESS, D. C., JR. *Phys. Rev.*, **71**, 270 (*Feb.* 15, 1947).—With the help of the mass spectrograph the following isotopic assignations were made: 6·6 d. Lu^{177}; 102 h. Yb^{175}; 2·5 h. Dy^{165}. W. E. D.

539.163.1 1604
Radioactivity of radioaluminium. DUNWORTH, J. V. *Nature, Lond.*, **159**, 436–7 (*March* 29, 1947).—Measurements of the author are reported which confirm those of Eklund and Hole [Abstr. 288 (1945)].

539.163.1 = 3 1605
Activation of inert gases by neutrons. RIEZLER, W. *Naturwiss.*, **33**, 53–4 (*July* 30, 1946) *In German.*—Half-

lives of 72 m and 4·6 h respectively are given for the Kr isotopes of masses 87 and 85, obtained from normal Kr by both fast and slow neutron irradiation. The decay of γ-activity of Xe^{133} was observed (*a*) after the γ-rays had traversed 0·1 mm Al, (*b*) with no absorber, the irradiated Xe gas being used as counter filling. Half-lives of 8·0 d and 9·5 d were found for the respective cases; a complex γ-ray spectrum is suggested as the cause of the discrepancy. A. P. F.

539.163.1 = 3 1606

Dual disintegration of potassium 40. Bleuler, E., and Gabriel, M. *Helv. Phys. Acta*, **20** (*No.* 1) 67–72 (1947) *In German.*—K^{40} disintegrates with continuous β-emission to Ca^{40}, but a transformation into A^{40} is also to be expected. This could be effected by positron emission or by *K*-capture. The latter process was investigated by absorption measurements on the X-rays emitted. The ratio of the occurrences K→A and K→Ca is $1·9 \pm 0·4$. The partial ½-life of the β-decay is $(7·0 \pm 1·0) \times 10^8$ years. A. J. M.

539.163.1/.2 1607

The half-life of Be^{10}. Hughes, D. J., Eggler, C., and Huddleston, C. M. *Phys. Rev.*, **71**, 269 (*Feb.* 15, 1947). —Be^{10} was produced by the (n, γ) reaction in the Hanford pile, and after careful separation of impurities was found to have a ½-life of $2·9 \times 10^6$ years, and to emit β-particles of energy $0·58 \pm 0·03$ MeV. W. E. D.

539.163.2 1608

Gamma- and beta-ray energies of some radioactive isotopes as measured by a thin magnetic lens beta-ray spectrometer. Rall, W., and Wilkinson, R. G. *Phys. Rev.*, **71**, 321 (*March* 1, 1947).

539.163.2 1609

Upper energy limit of the K^{40} beta-ray spectrum. Henderson, W. J. *Phys. Rev.*, **71**, 323–4 (*March* 1, 1947).—A more detailed description is given of measurements described earlier [*Phys. Rev.*, **55**, 238 (1939)], the upper limit being given as 1·3 MeV. W. E. D.

539.163.2 1610

Metastable state of half-life about 10^{-6} second in Re^{187}. De Benedetti, S., and McGowan, F. K. *Phys. Rev.*, **71**, 380–1 (*March* 15, 1947).

539.163.2 1611

Disintegration by consecutive orbital electron captures $_{56}Ba^{131} \rightarrow {}_{55}Cs^{131} \rightarrow {}_{54}Xe^{131}$. Fu-Chun Yu, Gideon, D., and Kurbatov, J. D. *Phys. Rev.*, **71**, 382 (*March* 15, 1947).—The energies of the various γ-rays emitted in these transitions have been measured. W. E. D.

539.163.2 1612

Range measurements of alpha-particles from $_{94}239$ and $_{94}238$. Chamberlain, O., Gofman, J. W., Segrè, E., and Wahl, A. C. *Phys. Rev.*, **71**, 529–30 (*April* 15, 1947).—The ranges have been measured by comparison with Po α-particles, and are found to be 3·68 and 4·08 cm of air. A.

539.163.2 1613

Gamma-radiation from polonium and from lithium bombarded with alpha-particles. Siegbahn, K., and Slätis, H. *Nature, Lond.*, **159**, 471–3 (*April* 5, 1947).—By study of the spectrum of Compton- and photo-electrons released from Pb by the γ-radiation from Po, its energy was found to be 0·773 MeV. No other γ-ray of comparable energy was found. [See Abstr. 4536 (1935)]. A similar observation with Li mixed with the Po indicated a γ-ray of energy 0·462 MeV from an excited state of Li^7. This agrees with the value obtained in another way [Abstr. 1614 (1947)], but contradicts Bothe's result [Abstr. 2931 (1936)].

539.163.2 : 539.165.2 161

The K-capture of Be^7. Siegbahn, K. *Ark. Mat. Astr. Fys.*, **34B** (*No.* 1) *Paper* 6, 6 *pp.* (1947).—Be^7 produces by $Li^6(d, n)$ Be^7 decays by electron-capture to Li^7, which has an excited state Li^{7*} [Abstr. 929 (1944)]. The γ-ray emitted by $Li^{7*} \rightarrow Li^7$ was measured from the spectrum of β-rays released by it from Pb, and found to be 453 ± 5 keV. This is compared with earlier determinations.

539.163.2 : 539.167.3 161

***L*-converted isomeric transition.** Goldhaber, M. Muehlhause, C. O., and Turkel, S. H. *Phys. Rev.*, **71** 372 (*March* 15, 1947).—The radiation associated with the 1·5 min Ir activity was found, contrary to earlier assumptions, to consist largely of *L* X-radiation of Ir. The cross-section for the activation of this isotope by thermal neutrons is estimated to be $\sim 10^{-22}$ cm². W. E. D.

539.163.4 : 545.8 1616

High-efficiency counting of long-lived radioactive carbon as CO_2. Miller, W. W. *Science*, **105**, 123–5 (*Jan.* 31, 1947).—Satisfactory estimation of C^{14} by counting, using $C^{14}O_2$ as filling gas, can be done by adding CS_2 vapour to the extent of 2 cm pressure. Practical details are given. The sensitivity is greater than with an electroscope [Abstr. 3233 (1946)].

539.164 : 539.172.4 *see Abstr.* 1632

539.165.2 : 539.163.2 *see Abstr.* 1614

539.167.3 : 539.163.2 *see Abstr.* 1615

539.17 1617

Cloud-chamber studies of electronic and nuclear stopping of fission fragments in different gases. Bøggild, J. K., Arrøe, O. H., and Sigurgeirsson, T. *Phys. Rev.*, **71**, 281–7 (*March* 1, 1947).—The reduced range of fission fragments was found to increase from Xe to He, and the range in He was ~18% > in A, in agreement with previous determinations. The reduced range in H was < in other gases, pointing to a comparatively larger electronic stopping effect. The range in D was ~ 6% > in H, and the difference must be ascribed to the nuclear stopping effect. The spread of the range within the groups was compared with energy measurements [Abstr. 134 (1946)], using Bohr's theory of the stopping effect [Abstr. 759 (1941)], and reasonable agreement obtained. The previous conclusions [Abstr. 760 (1941)] concerning the velocity-range relations of fission fragments were confirmed by new, more direct evidence, using close collisions for a determination of the velocity or mass of the fragments. A.

539.17 : 523.112 : 521.042 1618

Erratum: Expanding universe and the origin of elements. Gamow, G. *Phys. Rev.*, **71**, 273 (*Feb.* 15, 1947).—[See Abstr. 982 (1947)].

539.17 : 544.1 = 3 *see Abstr.* 1676

539.17 : 621.385.82 1619

A high tension apparatus for nuclear research. Bjerge, T., Brostrøm, K. J., Koch, J., and Lauritsen, T. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **18** (*No.* 1) 37 *pp.* (1940).—[Abstr. 1531 B (1947)].

539.172 1620

Nuclear properties of U^{233}: a new fissionable isotope of uranium. Seaborg, G. T., Gofman, J. W., and Stoughton, R. W. *Phys. Rev.*, **71**, 378 (*March* 15, 1947).

539.172 : 537.591 = 3 *see Abstr.* 1552

539.172 : 537.591.8 1621

Mechanism of capture of slow mesons. Wheeler, J. A.

hys. Rev., **71**, 320–1 (*March* 1, 1947).—Nuclear "stars" roduced at high altitude are too frequent to be accounted r entirely by meson absorption by nuclei. W. E. D.

39.172 : 537.591.8 = 5 1622

On the disintegration patterns on photographic plates. OVERA, G., AND CANDA, G. *Ric. Sci.*, **12**, 662–3 (*May*, 941) *In Italian.*—Results are given of the analysis of me plates exposed for 2 months at 1 800 m altitude. ost patterns are due to protons. One shows a peculiar branch design, 2 branches being attributed to 1·26 and ·70 MeV protons, the third to a 19·2 MeV proton. ne branch shows a sudden density increase, attributed γ-radiation. J. A. W.

39.172.1 1623

Disintegration of nitrogen into four α-particles by llision with deuterons. FOWLER, P. H., BURROWS, . B., AND CURRY, W. J. J. *Nature, Lond.*, **159**, 569–70 *April* 26, 1947).—Five "stars" were found in photo-raphic emulsions bombarded with 9 MeV deuterons, nd were interpreted as indicated.

39.172.3 1624

Evidence for a γ-*p* reaction in Be^9. OGLE, W., BROWN, ., AND CONKLIN, R. *Phys. Rev.*, **71**, 378 (*March* 15, 947).

39.172.3 1625

Photo-neutron sources and the energy of the photo-eutrons. WATTENBERG, A. *Phys. Rev.*, **71**, 497–507 *April* 15, 1947).—The radioactive isotopes which were ound to produce photo-neutrons in D_2O or Be or either are listed, and their γ-ray energies inferred. ight combinations appeared to give homogeneous eutron groups (energies tabulated), and the total eutron cross-section of C for these sources is given. A.

39.172.3 1626

A search for the transmutation products of gamma-eson reactions induced by 100 MeV X-rays. BONNER, . A., FREIDLANDER, G., PEPKOWITZ, L. P., AND ERLMAN, M. L. *Phys. Rev.*, **71**, 511–20 (*April* 15, 1947). -Irradiation with 100 MeV X-rays has been found to roduce Zn^{63} from Cu and Mg^{27} from Al. Experiments nvolving variations in beam energy and target thickness ave shown that these isotopes result from secondary eactions caused by photo-neutrons and photo-protons rom the target materials rather than from any primary, -ray-induced processes. No evidence for γ-meson eactions has been obtained. A search for the trans-nutation products of γ-meson reactions is shown to ompare favourably in sensitivity with cloud-chamber nethods for the detection of meson production, provided nesons are produced singly. A.

39.172.4 1627

The capture cross-section of boron for neutrons of nergies from 0·01 eV to 1 000 eV. SUTTON, R. B., ACDANIEL, B. D., ANDERSON, E. E., AND LAVATELLI, . S. *Phys. Rev.*, **71**, 272 (*Feb.* 15, 1947).—The cross-ection, σ, was measured for various neutron-velocities, , using a modulated cyclotron beam. σv is a constant, $\cdot 61 \pm 0 \cdot 02 \times 10^{-24}$ cm²m/μsec. W. E. D.

39.172.4 1628

Emission of light charged particles in the fission of ranium. GREEN, L. L., AND LIVESEY, D. L. *Nature, ond.*, **159**, 332–3 (*March* 8, 1947).—Examination of 5 000 U fission tracks in photographic emulsions ensitive to α-particles but not protons showed about 00 three-particle fissions. The light particles, probably -particles, were usually emitted at 90° to the fission ragments, and had all ranges up to 45 cm air equivalent; bout 1 in 4 had a range >8 mm air. No 4-particle fissions were observed. The fission fragments associated with the light particles were of unequal mass.

539.172.4 1629

On the new fission processes of uranium nuclei. TSIEN SAN-TSIANG, HO ZAH-WEI, CHASTEL, R., AND VIGNERON, L. *Phys. Rev.*, **71**, 382–3 (*March* 15, 1947).—Photo-graphs are given showing evidence for ternary and quaternary fission, the probability of their occurrence relative to binary fission being $0 \cdot 003 \pm 0 \cdot 001$ and $0 \cdot 0003 \pm 0 \cdot 0002$ respectively. W. E. D.

539.172.4 = 3 1630

Proof of the fission of ionium under neutron bombard-ment. JENTSCHKE, W., PRANKL, F., AND HERNEGGER, F. *S.B. Akad. Wiss. Wien.*, **151**, *Abt. IIa* (*Nos.* 4–6) 149–57 (1942) *In German.*—Thin preparations of Th and of a Th–Io mixture were successively mounted in an ionization chamber and irradiated with Rn–Be neutrons. The chamber was filled with purified H_2, and connected to an amplifier of $\frac{1}{2}$ μsec time-constant. Fissions were clearly distinguishable from the heavy background of Io α-particles. The fission yield of Io was found to be 2·7× that of Th. No fissions were observed with thermal neutrons. A. P. F.

539.172.4 = 4 1631

The fission of ionium by neutrons. CURIE, I., AND JOLIOT, F. *Ann. Phys., Paris* (*Sér.* 11) **19**, 107–9 (*April–June*, 1944) *In French.*—The β-activities of recoil fragments, produced from Th and from a Th–Io mixture of known composition by Be + D neutrons at 6·7 MeV bombard-ing energy, were measured. A ratio of 2·7 between Io and Th fragment activities was observed to hold through-out the period during whch the β-decay could be followed. This agrees with the fission cross-section ratio obtained by Jentschke *et al* [Abstr. 1630 (1947)] using Rn–Be neutrons. A. P. F.

539.172.4 : 539.164 1632

Long range alpha-particles emitted in connection with fission. Preliminary report. FARWELL, G., SEGRÈ, E., AND WIEGAND, C. *Phys. Rev.*, **71**, 327–38 (*March* 15, 1947).—These are emitted in coincidence (i.e. within 5×10^{-6} sec) with fission by U^{235} and Pu^{239}. The maxi-mum range observed corresponds to an energy of 16 MeV. About one α is emitted per 250 fissions by U^{235} and one per 500 fissions by Pu^{239}. A.

539.172.4 : 539.185.9 *see Abstr.* 1651

539.18 1633

Decay of mesons stopped in light materials. SIGUR-GEIRSSON, T., AND YAMAKAWA, A. *Phys. Rev.*, **71**, 319–20 (*March* 1, 1947).—Results indicate a decrease in capture probability of mesons with increasing atomic number of the absorber; absolute values are in disagreement with predictions from meson theory. W. E. D.

539.18 : 530.145 *see Abstr.* 1426

539.18 : 537.591 1634

The decay of negative mesons in matter. FERMI, E., TELLER, E., AND WEISSKOPF, V. *Phys. Rev.*, **71**, 314–15 (*March* 1, 1947).—It is pointed out that if the experi-mental result of Conversi, Pancini and Piccioni [Abstr. 1313 (1947)] is correct, then the meson interaction with nuclei is much less than has been assumed. This means that energies ⩾ the threshold energies will be required to produce appreciable numbers of artificial mesons by proton or photon bombardment. The production of meson pairs by photons is not affected by these results. W. E. D.

539.18 : 537.591.1 = 3 1635

Investigation of the mass of mesons. STEINMAURER, R.

Naturwiss., **33**, 54–5 (*July* 30, 1946) *In German.*—Tracks of 9 slow mesons obtained in 900 expansions of a long-sensitive cloud chamber with a field of 1 800 gauss at a height of 2 300 m yielded values of meson mass, 8 from the range-curvature relation, one by elastic collision with an electron. Concluded: that at least two values, of about 100 and 200 electron masses respectively, must be postulated. J. G. W.

539.18 : 537.591.1 = 5 1636

Determination of meson mean life. Cocconi, G. *Ric. Sci.*, **12**, 421–5 (*April*, 1941) *In Italian.*—Results are given of 2 series of measurements with 4 pairs of counters in coincidence: (*a*) in direction of 20° zenith angle with Pb shields of 140 and 592 g/cm², and at 42° with 140 g/cm²; (*b*) at 20° with 742 and 1 194 g/cm², and at 42° with 742 g/cm², using both the integral and the differential method of Pomerantz [Abstr. 880 (1940)]. The mean value is 3–4 μsec. [See Abstr. 922 (1940)]. J. A. W.

539.18 : 537.591.1 = 5 *see Abstr.* 1559

539.18 : 537.591.3 = 5 1637

On the absorption of fast mesons. Wick, G. C. *Ric. Sci.*, **12**, 858–73 (*July–Sept.*, 1941) *In Italian.*—Formulae for energy loss per cm path of a meson in an absorbing medium (Bethe, Fermi) are discussed, and using values for ionization potential obtained from α-particle absorption, the energy loss of mesons in air, water and Pb is calculated and the results are shown in nomograms. Vertical meson intensity in the atmosphere and under water is discussed and a discrepancy between Ehmert's results [see Abstr. 2110 (1940)] and those of others is explained. J. A. W.

539.181 1638

Molecular beam technique. Esterman, I. *Rev. Mod. Phys.*, **18**, 300–22 (*July*, 1946).—A review covering the following: ovens; slits and canals; collimating systems; various forms of detectors; fields of experimentation available with molecular beams. A bibliography of 69 items is included.

539.181 : 533.73 1639

The free fall of atoms and the measurement of the velocity distribution in a molecular beam of cesium atoms. Estermann, I., Simpson, O. C., and Stern, O. *Phys. Rev.*, **71**, 238–49 (*Feb.* 15, 1947).—The measurement of the intensity distribution in a molecular beam deflected by gravity represents the velocity distribution of the beam atoms and permits an accurate determination of this distribution. The results on K and Cs atoms using a path of ~2 m agree in general with those calculated for a modified Maxwellian velocity distribution in the beam. At larger deflections, i.e. for slow atoms, a deficiency of intensity was observed, which is explained by collisions in the immediate vicinity of the oven slit. A.

539.181 : 533.73 1640

The mean free paths of cesium atoms in helium, nitrogen, and cesium vapor. Estermann, I., Foner, S. N., and Stern, O. *Phys. Rev.*, **71**, 250–7 (*Feb.* 15, 1947).—Measurements were made with a molecular beam apparatus permitting the measurement of scattering deflections of about 5 seconds of arc. Utilizing the free fall of the beam atoms, the variation of the m.f.p. with the velocity of the beam atoms could be determined directly, and was found to agree with the equations calculated on classical theory treating the atoms as elastic spheres. The measured values of the sums of the effective atomic radii are given, and the corresponding mean free paths. A.

539.181 : 535.343 : 539.152.2 *see Abstr.* 1594

539.185 1641

On the distribution of the neutron energies in a moderator of infinite size. Eriksson, H. A. S. *Ark. Mat. Astr. Fys.* **33B** (*No.* 2) *Paper* 5, 8 *pp.* (1946).—The distribution appears as the solution of an integral equation, for which a method of solution is given; this includes an asymptotic formula for small energies. The range of validity of this formula was tested by computations for carbon and deuterium. L. S. G.

539.185 1642

The scattering of slow neutrons by bound protons. I. Methods of calculation. Breit, G. *Phys. Rev.*, **71**, 215–31 (*Feb.* 15, 1947).—The mathematical problem is stated in terms of a boundary condition and its equivalent integral equation. By means of the latter it is possible to calculate corrections to the results of Fermi. The corrections discussed > the inaccuracies of the boundary condition formulation, which are $\sim 10^{-5}$. A.

539.185 1643

The scattering of slow neutrons by bound protons. II. Harmonic binding—neutrons of zero energy. Breit, G., and Zilsel, P. R. *Phys. Rev.*, **71**, 232–7 (*Feb.* 15, 1947).—The cross-section for scattering by elastically bound protons is calculated by means of the method described in I. The results are expressed in terms of a correction factor to be applied to Fermi's factor 4. The results of numerical calculations for the effects of anisotropy in molecules with axial symmetry are presented in a figure. For scattering by the H_2O molecule the correction to be applied to Fermi's result is only ~0·3% of the final value. A.

539.185 1644

Electron waves in the magnetic dipole field of a neutron. Critchfield, C. L. *Phys. Rev.*, **71**, 258–67 (*Feb.* 15, 1947).—Spin inertia and retardation of the central field are neglected. When the total angular momentum of the system is zero the potential energy is positive at all radii only for the electron-neutron interaction. The positron-neutron potential becomes strongly negative in a small region near a separation of the order of e^2/Mc^2, where M is the mass of the neutron. The attraction is just sufficient to form a bound $P_{\frac{1}{2}}$-state of the positron with zero binding energy. The reality of such neutron-positron state is open to question. A.

539.185 1645

Total cross sections measured with photo-neutrons. Fields, R., Russell, B., Sachs, D., and Wattenberg, A. *Phys. Rev.*, **71**, 508–10 (*April* 15, 1947).—The total neutron cross-sections of 23 elements have been measured by use of 6 photo-neutron sources ranging from 0·024 MeV to 0·083 MeV. The cross-sections of the lighter elements behave very anomalously; broad resonances in the scattering are observed in F, Na, Mg, Al, and S. Nickel has the exceptionally high cross-section of 23×10^{-24} cm² at 0·024 MeV. The cross-sections of elements of atomic weight ~110 show very little variation with energy and are $\sim7\times10^{-24}$ cm². Three heavy elements have cross-sections of about 13×10^{-24} cm² at 0·024 MeV and decrease monotonically to about half that value at 0·83 MeV. A.

539.185 1646

Neutron experiments of the Physical Laboratory of Groningen. Coster, D., de Vries, H., and Groendijk, H. *Nature, Lond.*, **159**, 569 (*April* 26, 1947).—The correction to be applied to a number of resonance energies reported earlier (refs. given) due to 39% of impurity in the B used, is discussed.

39.185 : 548.0 1647
Theory of the refraction and the diffraction of neutrons by crystals. GOLDBERGER, M. L., AND SEITZ, F. *Phys. Rev.*, **71**, 294–310 (*March* 1, 1947).—The equations for the elastic scattering of neutrons by a single crystal, governing simple refraction, reflection, and Laue-Bragg scattering, are derived under the assumption that the scattering and absorption cross-sections are independent of spin. A brief summary of the results is given. A.

39.185.7 = 5 1648
On the collision of slow neutrons and protons. FERRETTI, B. *Ric. Sci.*, **12**, 512–15 (*April*, 1941) *In Italian.*—The impact cross-section by slow-neutron diffusion in ortho- and para-hydrogen depends critically on the form of the potential from which the nuclear forces are derived. A theoretical development assuming exponential decrease of potential leads to an explanation of discrepancies in previous results. J. A. W.

39.185.7 = 5 1649
On proton-neutron collision. I. AMALDI, E., BOCCIARELLI, D., AND TRABACCHI, G. C. *Ric. Sci.*, **12**, 30–42 (*July–Sept.*, 1941) *In Italian.*—Using the reaction $p + Li^7 \rightarrow Be^8 + n$ for the production of high-energy neutrons, recoil protons produced in a thin paraffin layer passing Al foil absorbers, whose thickness varied from 0–320 mg/cm², and 3 coincidence counters, the angular distribution of protons was measured for neutrons of initial energy $\geqslant$12 MeV. Apparatus is described in detail, results are tabulated, graphed and discussed, errors considered and the theory outlined. J. A. W.

39.185.7 = 5 1650
On the theory of collision of protons and fast neutrons. II. FERRETTI, B. *Ric. Sci.*, **12**, 843–52 (*July–Sept.*); 993–1019 (*Oct.*, 1941) *In Italian.*—Starting from Bethe's neutral nuclear theory [Abstr. 1329 (1940)] a general formula is derived for the differential impact cross-section in the elastic scattering of fast neutrons by collision with protons. The formula differs from Breit and Kittel's [Abstr. 4672 (1939)] in that spin and orbit interaction is considered and the phases of the scattered wave depend on the magnetic quantum number. A method of calculating the phases, applicable both to symmetric and neutral nuclei, is given. A pseudoscalar symmetric theory is discussed. J. A. W.

539.185.9 : 537.591.2 *see Abstr.* 1567

539.185.9 : 539.172.4 1651
Interaction of fast neutrons with beryllium and aluminum. ALLEN, K. W., BURCHAM, W. F., AND WILKINSON, D. H. *Nature, Lond.*, **159**, 473–4 (*April* 5, 1947).—Resonances at 2·6 MeV were observed with Be, both in the scattering cross-section and the cross-section for the reaction $Be^9(n,\alpha)He^6$ which was about 0·02 × the former. The width of the level in Be^{10} responsible for the resonant scattering is 0·8 to 1·0 MeV, corresponding to a life time of the excited state of $\sim 10^{-21}$ sec, or longer than the time taken for a 2·6 MeV neutron to cross the nucleus; there is thus some evidence for compound formation in the scattering process. A new resonance at 2·9 MeV was found in the scattering by Al.

STRUCTURE OF SOLIDS 539.2

539.213 : 535.66 *see Abstr.* 1506

539.215.2 : 539.37 *see Abstr.* 1656

539.22 : 538.221 *see Abstr.* 1575

539.23 : 539.62 : 532.516 *see Abstr.* 1435

539.26 1652
Composition and diffraction effects in X-ray microradiographs. SMOLUCHOWSKI, R., LUCHT, C. M., AND HURD, J. M. *J. Appl. Phys.*, **17**, 864–70 (*Nov.*, 1946).—See Abstr. 1006 (1947). Both composition gradients and diffraction produce contrast in X-ray microradiographs. Tilting the specimen slightly does not alter the composition-gradient pattern, but changes the diffraction pattern, thus distinguishing between the two effects. Applications to various alloys are described. A. J. C. W.

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.8

539.31 1653
Defence of the Cauchy relations. ZENER, C. *Phys. Rev.*, **71**, 323 (*March* 1, 1947).—Replying to Epstein [Abstr. 1008 (1947)] it is shown that Cauchy relations are expected on the assumption of central forces, and that each atom is at a centre of symmetry of the lattice. Failure of the relations indicate that these conditions do not exist in the lattice considered. W. E. D.

539.32 : 548.0 1654
The elastic constants of anisotropic materials. HEARMON, R. F. S. *Rev. Mod. Phys.*, **18**, 409–36 (*July*, 1946).—A review. The mathematical relations between stress and strain are quoted and the number of independent coefficients for each crystal class derived. "Pure" elastic constants are applicable when constraints are applied to suppress all strains except that corresponding with the measured stress, and "free" elastic constants are applicable when one stress only is applied. Static, dynamic, sonic and supersonic methods of measurement are described briefly. Expressions for the variation of Young's modulus and of the modulus of rigidity with direction are derived for some important special cases. Experimental results up to the end of 1944 are collected in a table. There are 125 references. A. J. C. W.

539.32 : 553.621 : 548.0 *see Abstr.* 1679

539.32.08 : 534.113 1655
The measurements of Young's modulus and its temperature coefficient for short filaments by flexural vibrations. YOUSEF, Y. L. *Phil. Mag.*, **37**, 490–7 (*July*, 1946).—The measurements were made in the temperature range 30 to 200°C, and the modulus was calculated in terms of the density, the radius and length of the filament, and the natural frequency of transverse vibrations when one end is rigidly clamped. The frequency was measured for amplitudes of about 0·0005 cm by vibrating the wire across a narrow beam of light falling on a photoelectric cell, and comparing the modulation by means of a c.r.o., with a calibrated oscillator (40–500 c./s.). Measurements may be made on filaments as thin as 0·001 cm and, if necessary, in a strong magnetic field. The temperature coefficient is large for materials with low melting points. L. S. G.

539.37 : 539.215.2 1656
Experimental evidence of the viscous behavior of grain boundaries in metals. T'ING-SUI KÊ. *Phys. Rev.*, **71**, 533–46 (*April* 15, 1947).—A simple torsional apparatus was devised for measuring anelastic effects at very low stress levels in polycrystalline Al; these effects were practically absent in single crystal Al. The effects observed are consistent with the viewpoint that the grain boundaries behave in a viscous manner. The maximum amount of shear stress relaxation is ~33%, in good agreement with the theoretical value of 36% calculated by assuming the grain boundary to be viscous. Similar anelastic effects have been also observed in polycrystalline magnesium, indicating that the viscous behaviour is common to all metals. A.

539.389.3 : 539.434 1657

On creep and relaxation. GROSS, B. *J. Appl. Phys.*, **18**, 212–20 (*Feb.*, 1947).—The creep and the relaxation function of linear systems, for which the principle of superposition is valid, are mutually connected in a simple way. This makes it possible to calculate the distribution function of relaxation times of stress and the distribution function of retardation times of strain, when the relaxation function or the creep function is given. It also allows a transformation formula to be established for the conversion of one distribution function into another. The results of the theory are applied to a detailed discussion of the relaxation process in a particular case. A.

539.4.016.2 : 538.224 *see Abstr.* 1578

539.42 : 539.89 : 539.56 1658

The effect of hydrostatic pressure on the fracture of brittle substances. BRIDGMAN, P. W. *J. Appl. Phys.*, **18**, 246–58 (*Feb.*, 1947).—Results are reported of observations made with an arrangement for the imposition of tensile stress superposed on hydrostatic pressures up to 30 000 kg/cm². Pyrex glass, Be, phosphor bronze, carboloy, NaCl, pipestone, and Al_2O_3 single crystals were investigated. In the discussion, the importance of the condition of energy release as a factor controlling fracture is emphasized. A.

539.433 : 620.178.311 : 534.113 = 3 *see Abstr.* 1447

539.434 : 539.389.3 *see Abstr.* 1657

539.56 : 539.89 : 539.42 *see Abstr.* 1658

539.62 1659

Friction and wear. WHITTAKER, E. J. W. *Nature, Lond.*, **159**, 541 (*April* 19, 1947).—The work required to abrade material from a surface will be a maximum if it is removed as single atoms. A calculation is made of the total heat of atomization of material removed by abrasion in an experiment, and it is found to be <1% of the frictional work expended.

539.62 : 539.23 : 532.516 *see Abstr.* 1435

539.89 : 539.56 : 539.42 *see Abstr.* 1658

539.893 : 549.211 : 536.424.1 *see Abstr.* 1510

PHYSICAL CHEMISTRY 541

CHEMICAL EQUILIBRIUM 541.121/.123

541.123 1660

Note on the conditions of equilibrium for systems of many constituents. BRINKLEY, S. R., JR. *J. Chem. Phys.*, **14**, 686 (*Nov.*, 1946).—Erratum. [See Abstr. 435 (1947)].

541.123.5 1661

Exchange between chromium ions and the Szilard effect. MUSCART, R., DAUDEL, P., DAUDEL, R., AND HAÏSSINSKY, M. *Nature, Lond.*, **159**, 538–9 (*April* 19, 1947).—Chromium in the form of sulphate, activated by slow neutrons, was mixed with K dichromate, but no exchange took place between Cr^{+++} and $Cr_2O_7^{--}$. Irradiated dichromate was mixed with Cr sulphate, but the latter, on separation, showed very small activity.

REACTION KINETICS 541.124/.128

541.126 : 534.222.2 1662

Spread around the initiating point of the detonation wave in high explosives. WEIBULL, W. *Nature, Lond.*, **159**, 402 (*March* 22, 1947).—The explosion of cylindrical charges of TNT was photographed on a moving-film camera with the detonator placed in various positions and orientations. The results showed the detonation to be propagated with uniform speed in all directions, without acceleration in the initial part of the travel.

ELECTROCHEMISTRY 541.13

541.133 : 537.311.3 = 82 1663

On the complexity of electric conductivity of electrolytes in an alternating electric field. DAVTIAN, O. K. *Bull. Acad. Sci. URSS, Dep. Sci. Tech.* (*No.* 3) 401–6 (1946) *In Russian.*—The phenomenon of the ionic "cloud," its relaxation period and behaviour in a.c. fields are described. It is shown that the electrolytic conductivity is not due to pure resistance only, and that the losses appearing are comparable with Debye losses in polarized liquids. A full mathematical analysis is given. A. L.

541.134 = 5 1664

The H^+ over-voltage in relation to the composition of the electrode material. CROATTO, U. *Ric. Sci.*, **12**, 1197 (*Nov.*, 1941) *In Italian.*—Using cathode materials of Pb–Cd and Pb–Sb alloys (anode Pt, solution 6/N KOH, 20°C) the deposition potential of H^+ was measured as function of c.d. The transition mixed-eutectic crystals is accompanied by a change in the over-voltage curve, min. for Pb–Cd, max. for Pb–Sb. J. A. W.

541.134 : 537.582 1665

Hydrogen overpotential and the thermionic work function. BOCKRIS, J. O'M. *Nature, Lond.*, **159**, 539–40 (*April* 19, 1947).—Recent re-evaluations of overpotential show that there exists an inverse correlation with work function for all metals which have been measured, a relatively low overpotential being associated with a relatively high work function. The causes of this are discussed.

541.144.7 : 536.62 = 4 *see Abstr.* 1516

COLLOIDS . DISPERSE SYSTEMS 541.18/.182

541.18 : 535.343.32 1666

Determination of the critical concentration for micelle formation in solutions of colloidal electrolytes by the spectral change of a dye. CORRIN, M. L., AND HARKINS, W. D. *J. Amer. Chem. Soc.*, **69**, 679–83 (*March*, 1947).—Work published earlier [Abstr. 3084 (1946)] has been extended to the use of other dyes, with both anionic and cationic detergents.

541.182.6 : 535.345.1 : 538.615 = 5 1667

Contribution to the study of the transparency variation of colloidal iron in a magnetic field. FRONGIA, G., AND AGUS, M. *Ric. Sci.*, **12**, 715–17 (*June*, 1941) *In Italian.*—Graphs of transparency to natural white light *v.* intensity of magnetic field ⊥ to the direction of propagation of light show an initial decrease to a min. followed by increase. This is compared with a birefringence curve. [Abstr. 137 (1940)]. J. A. W.

541.182.6 : 535.43 *see Abstr.* 1501–2

ADSORPTION 541.183

541.183.26 : 621.385.1.032.182 = 4 1668

The adsorption of some gases and their binary mixtures by carbon, with relation to the regeneration of neon tubes. LINDEBOOM, J. *Rec. Trav. Chim. Pays-Bas*, **65**, 817–90 (*Dec.*, 1946) *In French.*

.183.56 1669
roperties of films of nitrogen on tungsten. BOSWORTH, C. L. *J. Proc. Roy. Soc. N.S.W.*, **79**, 166–71 (1945).—e films, studied by the contact potential method, were mobile at 90° and mobile at 740°K. The heat of orption E fell from ~28 for a clean, to 17 kcal/mole a completely covered, surface. S. J. G.

.183.56 1670
Evaporation of oxygen from a tungsten surface. BOSRTH, R. C. L. *J. Proc. Roy. Soc. N.S.W.*, **79**, 190–5 945).—See Abstr. 1669 (1947). *E* for O falls from 150 for clean, to ~65 kcal/mole for completely vered, W. The spreading force of the complete film 2 880 dyne cm^{-1}. The film structure is probably of peroxide type. S. J. G.

.183.56 = 4 1671
Measurements of activated adsorption by nickel foil tween 200° and 500°. VAN ITTERBEEK, A., MARIENS, P., D VAN PAEMEL, O. *Ann. Phys., Paris* (*Sér.* 11) **18**, 135–(*April–June*, 1943) *In French.*—The isobars of H_2 show reak at ~360°, those of D_2 at ~410°. These may be nnected with the anomalous thermal expansion of Ni the region of its Curie point (~350°). S. J. G.

1.183.56 : 533.15 *see Abstr.* 1440

1.24 : 535.435 *see Abstr.* 1502

CHEMICAL STRUCTURE 541.4/.6

1.57 1672
A re-evaluation of the covalent radii of some of the ements. GORDY, W. *J. Chem. Phys.*, **15**, 81–4 (*Feb.*, 947).—The Schomaker–Stevenson correction [Abstr. 0 (1941)] is extended to double bonds. Several revisions the table of covalent radii are proposed (O, N, C). he newly assigned values are shown to be consistent ith double bonds formed between unlike atoms when e shortening caused by ionic character is taken into count. Some other covalent radii are determined by trapolation. A.

41.6 : 535.347 : 535.58 = 4 *see Abstr.* 1504

41.651 : 535.343.32 = 4 *see Abstr.* 1481

CHEMICAL APPARATUS 542.1/.7

42.3 1673
A microburette for producing small liquid drops of nown size. LANE, W. R. *J. Sci. Instrum.*, **24**, 98–101 *April*, 1947).—The drops are formed at the tip of a ypodermic needle round which is flowing a concentric stream of air. By varying the speed of the air, the size of the drops delivered from the microburette can be varied over a wide range. A.

542.73 1674
A gas blending system. LANGER, A. *Rev. Sci. Instrum.*, **18**, 101–3 (*Feb.*, 1947).—Apparatus is described, for use with mass spectrographic or infra-red analysis, in which the pressure of each component may be measured separately in a constant volume and then completely transferred to a storage chamber.

542.73 = 82 1675
Mercury aspirator of a new type. TITOV, N. G. *Bull. Acad. Sci. URSS, Dep. Sci. Tech.* (*No.* 2) 311–12 (1946) *In Russian.*—A new simple portable aspirator, particularly suitable for investigations at low temperatures, is described. By use of two symmetrical trap vessels, the apparatus is made periodically reversible, thus being able to deal with large gas volumes. A. L.

CHEMICAL ANALYSIS 543/545

544.1 : 539.17 = 3 1676
The chemical separation of the elements originating in uranium fission. I. HAHN, O., STRASSMANN, F., AND SEELMANN-EGGEBERT, W. *Z. Naturforsch*, **1**, 545–56 (*Oct.*, 1946) *In German.*—The analytical methods for separating the elements in groups are given. For rapid work, methods are outlined for the direct separation of single elements. A.

545.38 1677
Conductimetric analysis at radio-frequency. BLAKE, G. G. *J. Sci. Instrum.*, **24**, 101–2 (*April*, 1947).—Arrangements for titration are described in which a length of Pyrex glass tube fitted with external electrodes replaces the usual type of conductivity cell. The resistance of the solution under analysis is measured (*a*) by its effect upon the *Q* of the oscillator, and (*b*) by its resistance to radio-frequency currents, which are rectified and then measured by a zero-shunted microammeter. [See Abstr. 692 (1947)]. A.

545.8 : 539.163.4 *see Abstr.* 1616

545.824 : 548.73 1678
Apparatus and techniques for practical chemical identification by X-ray diffraction. SMITH, C. S., AND BARRETT, R. L. *J. Appl. Phys.*, **18**, 177–90 (*Feb.*, 1947).—A general review, with particular emphasis on the use of long wavelength X-rays, intended for those not expert in X-ray diffraction. A.

CRYSTALLOGRAPHY 548

48.0 : 537.311.32 *see Abstr.* 1524

48.0 : 539.185 *see Abstr.* 1647

48.0 : 539.32 *see Abstr.* 1654

48.0 : 539.32 : 553.621 1679
Remarks on C. Frondel's letter "Elastic deficiency and olor of natural smoky quartz." PRZIBRAM, K. *Phys. ev.*, **71**, 319 (*March* 1, 1947).—See Abstr. 2400 (1946).

48.51 : 535.417 : 549.623.5 1680
New contributions to interferometry. VIII. Intererometric examination of small local irregularities in ica. TOLANSKY, S. *Phil. Mag.*, **37**, 453–62 (*July*, 946).—Two irregularities were studied by methods reviously described [Abstr. 1192 (1947)]. The first onsisted of a small surface hillock adjacent to a complex cclusion pocket. The hillock is interpreted as being a rowth nucleus ~2 500 Å high, built up in 34 discon-inuous steps. The second irregularity was a hillock flanked by two valleys, due to the inclusion of a small transparent foreign solid body during the laying down of the mica. L. S. G.

548.7 : 538.222 *see Abstr.* 1576

548.73 1681
The lattice structure of clay minerals. BAGCHI, S. N. *Indian J. Phys.*, **20**, 54–80 (*April*, 1946).—A review with bibliography of about 100 entries.

548.73 1682
Approximation for absorption displacement in X-ray diffraction by highly absorbing cylindrical samples. WILCHINSKY, Z. W. *J. Appl. Phys.*, **18**, 260–1 (*Feb.*, 1947).—See Abstr. 613 (1946).

548.73 : 545.824 *see Abstr.* 1678

549.211 : 539.893 : 536.424.1 *see Abstr.* 1510

549.623.5 : 535.417 : 548.51 *see Abstr.* 1680

GEOPHYSICS 55

550.34 : 534.2 = 5 *see Abstr.* 1448

550.341 : 534.213 *see Abstr.* 1451

550.38 : 538.712 = 5 1683

New method of measuring magnetic declination and dip. TENANI, M. *Ric. Sci.*, **12**, 1135–40 (*Nov.*, 1941) *In Italian.*—Two identical transformers, with parallel placed cores of easily saturated metal (mumetal), are connected on the frequency-doubling principle. The secondary e.m.f. vanishes when d.c. premagnetization vanishes, and if this is due to the earth's field, the direction of the latter can be found. The primary current is generated by a thermionic oscillator (160–170 c/s) and the position of a theodolite with movements around a vertical and a horizontal axis, with respect to the meridian and horizon, gives the values of declination and dip with a mean error of $\pm 5{\cdot}2'$. J. A. W.

550.385 : 523.72 = 3 *see Abstr.* 1395

METEOROLOGY 551.5

551.515.4 : 551.594.6 : 621.396.821 1684

Location of thunderstorm centres from directional observations of atmospherics during sunrise and sunset. KHASTGIR, S. R., DAS GUPTA, M. K., AND GANGULI, D. K. *Nature, Lond.*, **159**, 572–3 (*April* 26, 1947).

551.521.1 : 523.77 *see Abstr.* 1401

551.593.5 : 535.361.1 = 5 *see Abstr.* 1488

551.594.221 : 621.316.993 : 621.316.933 1685

Lightning investigation on transmission lines. LEWIS, W. W. *Conf. Int. Gr. Rés. Élect.* [*CIGRÉ*] (*Rep. No* 313) 12 *pp.* (1946).—[Abstr. 1424 B (1947)].

551.594.6 : 621.396.821 : 551.515.4 *see Abstr.* 1684

553.621 : 539.32 : 548.0 *see Abstr.* 1679

BIOLOGY 57/59

576.8.095.13 : 664.8/.9 1686

Ultrashort application time of penetrating electrons: a tool for sterilization and preservation of food in the raw state. BRASCH, A., AND HUBER, W. *Science*, **105**, 112–17 (*Jan.* 31, 1947).—An impulse generator (Capacitron) is arranged to give 50–100 impulses per min of 3·5 MeV electrons, each lasting about 10^{-6} sec. The penetration of the electrons in water is about 12 mm. Materials such as distilled water, plasma, penicillin powder, contaminated by bacteria, can be sterilized by exposure to one or a few impulses. A larger machine contemplated is expected to sterilize up to 600 litres per min. Various meat, fish, milk, fruit and vegetable products, after exposure in 10 g quantities to 3 to 25 impulses, can be kept much longer without spoiling than untreated products. D. E. L.

578.087.87 : 621.316.542.9 1687

A mechanical switch for use in some bioelectric measurements. HOYT, R. C. *Rev. Sci. Instrum.*, **18**, 61–3 (*Jan.*, 1947).—[Abstr. 1404 B (1947)].

MEDICAL SCIENCE . HUMAN PHYSIOLOGY 61

615.831 : 621.326.4 1688

The "Infraphil": an apparatus for infra-red therapy. MANDERS, T. J. J. A. *Philips Tech. Rev.*, **8**, 177–82 (*June*, 1946). — A lamp is described whose spectral characteristics are suitable for the maximum penetration of radiation into tissue. A.

615.849 : 537.534 1689

Radiological use of fast protons. WILSON, R. R. *Radiology*, **47**, 487–91 (*Nov.*, 1946).—Recent developments permit the production of protons with penetrations in tissue of body dimensions. A proton penetrates tissue in a nearly straight line; the ionization and resultant dosage increase as the velocity is decreased, and thus the ionization is greatest in the last cm of its path. Hence with deep application the skin dosage is small and, with suitable collimators, well-defined narrow beams can be applied with precision. It is shown that depth of maximum ionization can be controlled by the relative potential of excitation, and the proton current equivalent to the dosage of a Roentgen is calculated. Not all the protons reach the same depth, and "straggling" and scattering occur, also liberation of α-particles and neutrons. Practical considerations and dangers of use are discussed [see Abstr. 1545 (1947)]. B. J. L.

615.849 : 537.534.74 *see Abstr.* 1545

615.849 : 621.386.7 1690

Application of the inverse square law to oil-immersed tubes. LANDAUER, R. S. *Radiology*, **48**, 175–9 (*Feb.* 1947).—Doubt has been expressed as to the application of the inverse-square law for modern diagnostic and therapeutic X-ray tubes with small target-skin distances of application, as the focal spot is not an actual point source and there is an oil medium between the tube and patient. Tests were made on 11 tubes and it was found that inverse square law may be used with an average error $> 1\%$ at distances from 20 to 5 in from the tube, with a maximum error not exceeding $\pm 6\%$. B. J. L.

PHOTOGRAPHY 77

778.3 : 539.16 *see Abstr.* 1596

778.33 1691

On contrasts in X-ray pictures: a comparison of the influence of the wave-length with that of the size of the representing beam. DE WAARD, R. H. *Proc. K. Ned. Akad. Wet.*, **50** (*No.* 1) 207–14 (1947).—Formulae are derived by which contrasts in radiographs can be estimated. It is shown that a wavelength increase affects contrast chiefly in the dark parts of the image, and a reduction of beam diameter affects it chiefly in the lighter parts. H. M.

778.35 : 535.317 *see Abstr.* 1466